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The Electricity Commission.

RUMOURS which have been astir for some time past have been confirmed by the recent announcement of the Ministry of Transport—that Mr. S. L. Pearce, C.B.E., is leaving the Electricity Commission, and that Mr. T. P. Wilmshurst, M.B.E., is joining it. Our congratulations are due to both these gentlemen, who are so well known and so highly esteemed in electrical circles that we are sure our readers will join with us in our felicitations. It may seem somewhat inconsistent to congratulate them on changes diametrically opposed, but as they themselves have chosen to make those changes, it is obvious that each of them contemplates his future with satisfaction—and surely that is a most appropriate matter for congratulation!

Whilst Mr. Pearce, the most recently appointed member of the Commission, has held office for only 17 months, his time has been fully occupied; even before his appointment he was advising the Government in connection with the Report of Lord Weir's Committee, and afterwards he was busily engaged in the preparation of the Electricity (Supply) Bill and in facilitating its passage through the House of Commons. As Lieut.-Col. J. T. C. Moore-Brabazon, M.C., told the Electrical Power Engineers' Association on Saturday last, Mr. Pearce had coached him in respect of the technical aspects of the Bill, with infinite patience; and certainly the Parliamentary Secretary's utterances on the subject seemed to us to be well-informed, though unfortunately, as he confessed, they were unintelligible to the honourable members upon whose votes the fate of the Bill depended. But we are inclined to believe that Mr. Pearce's most notable achievement was the maintenance of the supply of electricity during the general strike, a triumph of organisation, foresight, and execution. Little has been published with regard to this subject, and, of course, in accordance with the usage of the Civil Service, the department receives the credit for the admirable work that was accomplished; but his colleagues would be the first to accord to Mr. Pearce the praise that is his due for successfully coping with a situation of unprecedented difficulty, at a time of national emergency.

As regards the future, Mr. Pearce is returning to his old love. Years ago he was on the staff of the Metropolitan Electric Supply Company; for 21 years he was at the head of the Manchester Electricity Supply

Department, the largest municipal undertaking in the kingdom; and now he takes up the reins as engineer-in-chief of the London Power Company, probably the most onerous and responsible position of its kind in this country. We are glad to know that the electricity supply of so large a part of the Metropolitan area will be in unquestionably competent hands, though we cannot help regretting that the Electricity Commission, which under the Bill is to be charged with the preparation of a national development scheme of enormous magnitude, will lose the benefit of Mr. Pearce's technical knowledge and experience.

Of Mr. T. P. Wilmshurst, the new Commissioner, it can truly be said that he is one of the most popular, and deservedly popular, men in the electrical engineering profession. For the past 28 years he has had control of the electricity department of the Derby Corporation, and during that time he has developed the undertaking from small proportions to its present degree of importance, supplying electricity in an area of over 100 square miles. Mr. Wilmshurst is chairman of the Engineers' Advisory Committee of the East Midlands Advisory Board, and the experience gained in that capacity will doubtless prove of great value to him in his new office.

There still remains a vacancy on the Electricity Commission, and in view of the new duties which are to be imposed upon that body—such as the preparation of the scheme, or schemes, for the development of electricity generation, the interconnecting grid, the standardisation of frequency, and other momentous changes—in addition to the large and increasing volume of routine work which is constantly flowing in, it seems desirable that the fifth member should be appointed without further delay. Moreover, whilst the present *personnel* is admirably equipped with administrative, financial, and executive talent, it seems to us essential that the post should be filled by an engineer of the highest standing, personally familiar with the direction of undertakings of the first magnitude, involving the erection of long transmission lines at very high pressures, such as will be needed for the "grid" if the scheme foreshadowed in the Bill is carried out. It may be urged that the Electricity Commissioners can obtain all the technical advice that they require from outside their ranks, and that their duties are rather administrative than engineering; but that would mean that they would be ruled by their advisers, and that a long step would be taken towards the conversion of the Commission into a bureaucratic department, a fate which threatens all such bodies and which it is very difficult to avert. To what extent, if any, outside influence has made itself felt already we do not know, but there are not lacking those who surmise that an unseen hand is pulling strings. We want the Electricity Commission to be so strong that it will be able to resist pressure from any unauthorised source, whether political or not.

The Progress of the Campaign.

Substantial progress has already taken place in the ranks of the electrical trade itself in connection with the "Wiring the Homes of Britain" campaign. More than half-a-million books have been sold to electricity supply undertakings, electrical contractors and others, and a second edition is being rushed through as rapidly as possible. Curiously enough, however, after all the publicity that the scheme has received, there are still engineers and contractors who have not read the E.D.A. Trade Programme No. 1,000, which sets out the whole machinery of the effort. We would urge everyone who has received this document to read it at once, and pass it on to his various commercial assistants so that they may become thoroughly familiar with the scheme. The E.D.A. E.L.M.A. officials will be grateful if all orders for publicity and other material can be placed with the least possible delay. We are sure that it will be at once recognised that all electrical traders should have their supply of competition books available in readiness to meet the public demand directly the advertisements appear in their locality. It is unpleasing to contemplate inquirers being sent empty away.

Numerous meetings of the seven provincial area sub-committees have been held, and we report in our "Business Notices" what took place at one held last Friday by the London Area and Home Counties Committee, at which measures were reviewed for stimulating interest through various channels.

The E.D.A. Conferences.

In a week's time the sixth consecutive series of conferences under the auspices of the British Electrical Development Association commences. It is worthy of note that these are no longer denominated "salesmanship" conferences, the reason being that, although the "selling art" is still a subject of discussion at the meetings, the range has been widened to admit discussions of more general interest to those engaged in the distribution of electrical goods and in electrical development generally. This is not to say that the conferences are no longer of service to the salesman; on the contrary, the opening of the meetings to more general matters should prove beneficial to him.

Previous conferences have been largely devoted to the demonstration of selling *methods*, but the salesman also needs a thorough equipment of selling *facts*, and he should be able to add extensively to this equipment from the papers which are to be presented by experts in electricity supply and wiring schemes; industrial heating; refrigeration, &c.

The principal idea of the conferences is the exchange of information and experiences, and they perform a useful function in bringing together people in different branches of the industry whose points of view are sometimes very dissimilar. This inevitably leads to an appreciation of the difficulties of others and is all to the good of the industry as a whole.

A Giant Turbo-generator.

A steam-driven turbo-generator, nearly three times as large as any in service to-day is being built at the Schenectady works of the General Electric Co., of America, for the new State Line station on Lake Michigan.

The machine will, as pointed out by *Power*, be unique in several respects: not only will it be rated at 208,000 kW, but it will also incorporate the largest 1,800-r.p.m. generator ever constructed. Moreover, it is said to be the first designed to generate at 18,000 volts, but the claim that it will be the first to utilise live steam for reheating the steam exhausted by the high-pressure turbine before it is fed to the low-pressure cylinders cannot be upheld, for "this is one of the features of the plant" of the Barking station of the County of London Electric Supply Co., Ltd., the first section of which was formally inaugurated 16 months ago. The system was also adopted at the North Tees generating station, the building of which commenced in 1917.

The American set will consist of three cylinders. Steam will be admitted at a pressure of 600 lb. per sq. in., and a temperature of 730 deg. F., to the 76,000-kW h.p. element, which will exhaust it into a live-steam reheater, whence, its temperature having been raised to 500 deg. F., it will be fed into the two l.p. 66,000-kW elements; each of the latter will have attached to it a 4,000-kW service generator.

The enormous size of the machine can be judged from the statement that it will have a capacity of 63 per cent. of that of the Niagara Falls Power Co.'s hydro-electric generating station. The weight of the turbo-generator will be about 4,000,000 lb.; 400,000 gallons of condenser cooling water will be needed, and 350,000 cu. ft. of generator cooling air, per minute, while the plant's steam consumption will necessitate the burning of over two tons of low-grade Illinois coal per minute.

The American G.E. Co. has accomplished many engineering feats of magnitude, and it will be interesting to note whether its promise to deliver this giant set in 18 months can be kept.

Sydney Suburban Railway Electrification.

A Further Large Metropolitan-Vickers Contract from Australia.

The electrification of Sydney City and Suburban Railways in Australia is one of the most important projects of its kind yet undertaken. The inception of the scheme dates from 1915, when the problem of improving transport facilities for a rapidly increasing population was thoroughly investigated by the New South Wales Railway Commissioners. A full report on the "Proposed Electric Railways for the City of Sydney," was prepared by Mr. J. J. C. Bradfield, chief engineer of Sydney metropolitan railway construction, after a personal study of the electric railways operating in Europe and America, and on the basis of that report a very comprehensive scheme was adopted which provided (see fig. 1) for the construction of an underground loop railway for two-way service in the city of Sydney itself, for the construction of a number of new lines into the outlying districts, and for the gradual electrification of practically all the railways within an area of about 20 miles radius, the total amount of electrification being about 400 track miles. The work is bound up with the new bridge now being erected across Sydney Harbour, for one of the most important railway extensions is a

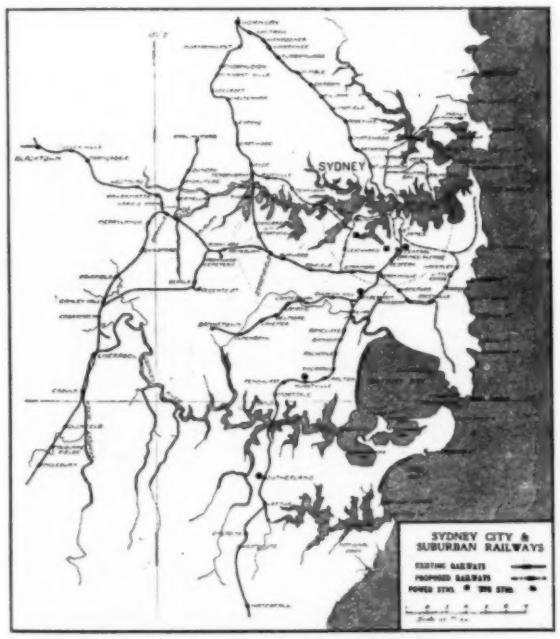


Fig. 1—Sydney City and Suburban Railways.

new section of line which will pass over the new bridge, forming a direct route from Sydney City to the north.

The commencement of work was delayed owing to the war, and it was not until 1923 that the specifications were issued covering the rolling stock and equipment for the first section to be electrified, namely, the Illawarra line, between Sydney central station and Sutherland. The main features of the original plan were adhered to, including the decision to adopt multiple-unit trains as being the most economical means of obtaining fast and frequent service on suburban lines, and also an overhead trolley line. In 1925 a contract was placed with the Metropolitan-Vickers Electrical Co., Ltd., for complete electrical equipment for 150 motor coaches and 150 trailers.

A considerable number of these coaches are now in operation on the Illawarra line, on which a service as far as Mortdale was inaugurated in February last, and an additional contract for similar equipment for 101 motor coaches and 101 trailers has now been placed with the same company. Fig. 2 shows one of the motor coaches out on trial on the Illawarra line. One motor coach and one trailer constitute a train unit, and trains of one, two, three or four two-coach units are made up as required. The coaches are 61 ft. 6 in. in length, and have a seating capacity of 79 passengers in the case of

Fig. 2.—Motor Coach on Trial Run on Illawarra Line.

motor coaches, and 83 passengers in the case of trailer coaches.

The equipment of each motor coach includes two motors, each of 360 h.p., probably the most powerful individual motors ever installed for multiple-unit trains. They are of the box-frame type, mounted on the axles of the rear bogie of the coach; they are wound for a line pressure of 1,500 volts, each pair of motors being controlled in series-parallel connection. A special feature of the motor design, patented by the Metropolitan-Vickers Co., is that in order to obtain the large output required in the limited space available within the trucks, the armature slots are tapered, and armature coils wound of special strip are used; by this method a considerable increase in output for a given size of armature is obtained. The armature coils are insulated with mica and asbestos, and the Company's new process of bakelising the coils at various stages of their manufacture is used. The motors have commutating poles, and are self-ventilated with a fan mounted on the motor shaft.

Multiple-unit control of the electro-pneumatic type is provided, the control gear being energised from a 36-

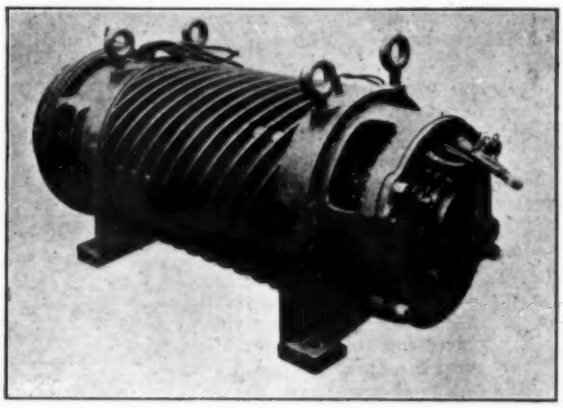


Fig. 3. - Motor-generator Set with Cover Removed.

volt circuit which is served by a motor-generator set and stand-by battery. The master controller in the driver's cab controls, through small electromagnets, air valves connected with the compressed-air supply which actuates

pistons and closes the main contactors; the contactors with their operating pneumatic cylinders and magnetically-operated valves are assembled in switch groups, which are mounted under the cars in order to leave the body space of the coach as free as possible. The motor-generator set referred to above is also mounted under the car; it takes current at the line pressure of 1,500 volts, and gives a low-voltage supply for lighting and for the operation of the control gear. The set is provided with special ventilating ducts in the iron parts of the stator and rotor (see figs. 3 and 4) through which air is drawn by a fan on the rotor. Fig. 3 shows the set with its casing removed; the casing fits closely to the spiral grooves, thus completing the ventilating ducts along which the air is drawn through the apertures shown in the end-brackets. Fig. 4 illustrates the armature and end-plates of the machine; the four apertures to be seen within the ball-bearing admit air to longitudinal ducts through the body of the armature. The cooling air does not come into contact with the windings, and the set thus furnishes the output of a ventilated motor with all the advantages of a totally-enclosed machine. This arrangement is patented by the Metropolitan-Vickers Co., as is also a special design of automatic voltage regulator which is used in connection with the motor-generator set. In addition to the motor coach control gear, a number of the trailer coaches will also be provided with driving cabs.

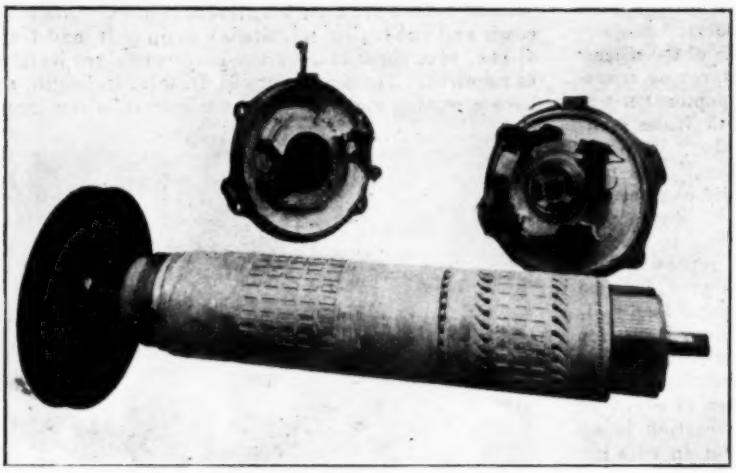


Fig. 4.—Armature and End-plates of Motor-generator.

It is interesting to note that in actual operation the trains already in service attain an acceleration of 1.37 miles per hour per second, which is about four times the acceleration of steam trains. In maintaining a rapid service with frequent stops this is an advantage of very great importance.

Power for operating the Illawarra line is taken from the Ultimo electricity generating station, near the Sydney central railway station, and the White Bay electric power station about three miles to the east. The Ultimo power station supplies the Prince Alfred sub-station at 6,600 volts, 25 periods, while the White Bay power station is connected by six 11,000-volt, 50-period, underground lines to the Meeks Road sub-station at Sydenham, whence duplicate 33,000- and 11,000-volt overhead lines connect to the sub-station at Hurstville.

Rotary converter sets of exceptionally large size, equipped for semi-automatic control, have been supplied by the Metropolitan-Vickers Co. for sub-stations on this line. The two 4,500-kW, 1,500-volt machines shown in fig. 6 are installed at the Prince Alfred sub-station; they have sixteen poles, and run at 187½ r.p.m.; they can carry an overload of 25 per cent. for two hours, and a momentary overload of 10,000 kW each. Special fireproof insulating barriers are fitted in front of the commutator risers and between adjacent pairs of brushes to cool and deflect any arcs which may be produced by short circuits, and thus render the machines immune from damage under severe traction conditions. At the Hurtsville sub-station there are two 1,500-kW, 750-V, Metrovick rotary converters of similar construction, connected in series to form a 3,000-kW, 1,500-V set; they have twelve poles and operate at 500 r.p.m. The automatic contactor gear which controls the rotary converters in each sub-station is installed alongside the machines in a screened enclosure. The sub-station operator works outside this protected area, and starts the sets by a push-button, which causes the main oil circuit-breaker to close; the steps of starting, synchronising, and correcting polarity then follow automatically, and the attendant has only to operate another push-button to close the d.c. circuit-breaker. The control panel for the 3,000-kW set at the Hurstville sub-station is shown in fig. 5.

The high-voltage switchgear for the three sub-stations which are in commission on the Illawarra line has also been supplied by the Metropolitan-Vickers Co. The 33,000-volt switchgear includes electrically-operated oil circuit-breakers of the outdoor type, each unit having a breaking capacity of 160,000 kVA. The 11,000- and 6,600-volt circuit breakers are mainly of the semi-metal-

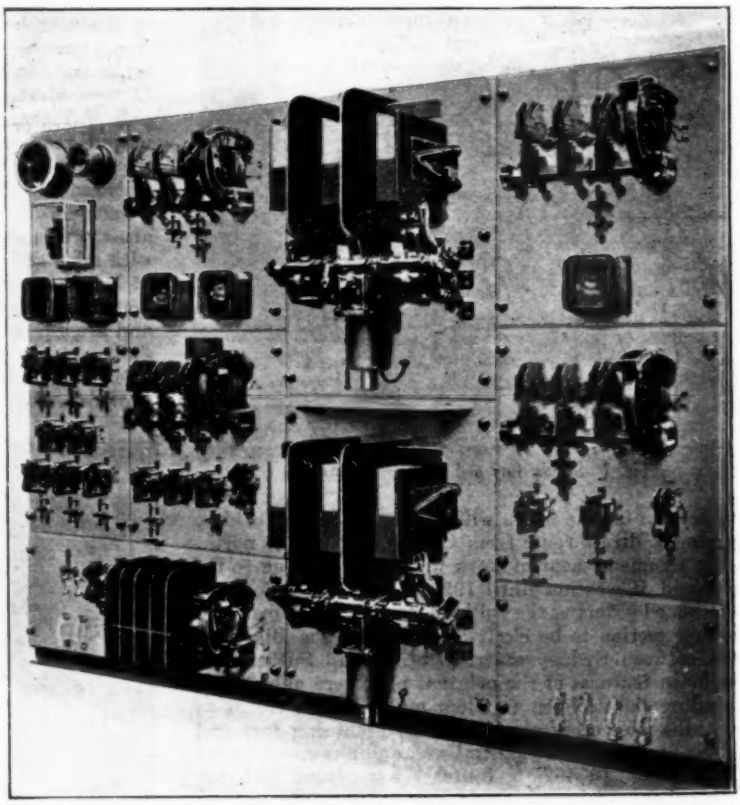


Fig. 5.—Contactor Panel for Controlling 3,000-kW Rotary Converter.

clad type, in which the circuit-breaker itself is built on metal-clad lines, while the remainder of the apparatus is contained in a masonry cubicle. Provision is made in the switchgear layout at the Hurstville sub-station for extension of the h.p. line to the Sutherland sub-station, which will serve the next section of the line.

The electrification of other lines is expected to follow in the order of Bankstown section, Sydney to Parramatta, Sydney to Hornsby *via* Strathfield, and Sydney to Hornsby, *via* the Sydney harbour bridge.

In conclusion, attention may be drawn to the fact that the motor-generator set illustrated in figs. 3 and 4 is a new machine, the design of which incorporates several interesting features, and it is believed that this is the first occasion on which details of its construction have been published. It may also be mentioned that the contract for the above-described equipment is the second which the Metropolitan-Vickers Electrical Co., Ltd., has secured within 21 months for this important railway electrification scheme, representing a total of 502 motor and trailer coaches.

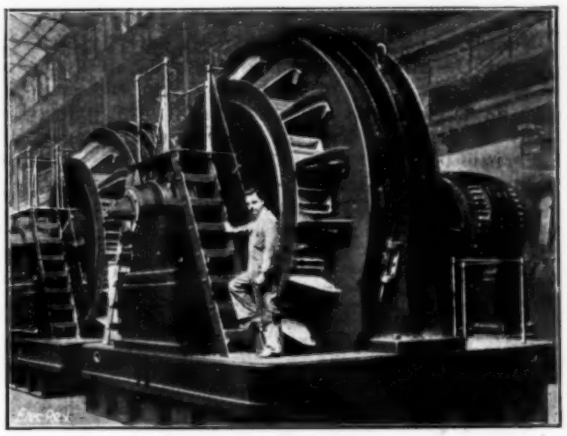


Fig. 6.—Two 4,500-kW 1,500-Volt Rotary Convertors.

The Structural Design of Overhead Lines.

The Spacing of Conductors and their Clearances.

By Wm. POOLE.

The spacing of conductors and their clearance to earth on overhead transmission lines, and the subsidiary questions incidental to these have from time to time received considerable attention from engineers, but the subject is by no means exhausted. These distances fall naturally into four groups, *viz*:—Conductor to surface of ground below, conductor to earth at the support (*i.e.*, insulator size and thickness), conductor to earthed parts of the supporting structure in general, and conductor to conductor.

Height of Conductor Above Ground.

The height of the lowest conductor above ground is a matter which not only affects the public, but also determines the length and thickness of the poles or towers supporting the conductors. It is the only clearance which is legally controlled, and as the legal minimum of 20 ft. for the voltages in ordinary use in this country is considered by most engineers to be ample, there is little variation in practice. It is frequently contended that the limit might be safely reduced for some classes of line (as, for instance, small lines feeding one or two isolated houses, or lines running over marsh or moor land, where no-one ever goes except on foot), but the difficulty of specifying such lines, places and conditions, and at the same time safeguarding the public is such that generalisation is the only practicable course. It should, however, be borne in mind that the Electricity Commissioners have power to reduce the limit if they are convinced of the wisdom of doing so in special cases.

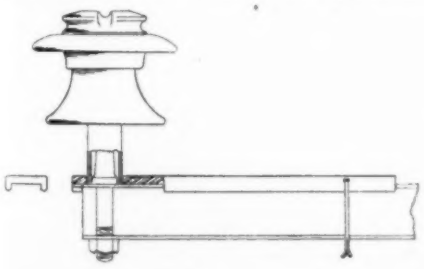


Fig. 1.

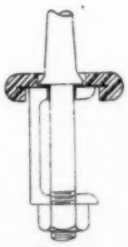


Fig. 2.

Conductor to Earth Clearance at Support.

This distance is largely governed by the properties of the insulating material used. It is consequently a problem for the insulator manufacturer, and is a part of the subject with which it is not proposed to deal.

Conductor to Cross Arms, &c., Clearance.

This is a matter which must be dealt with by every designer of overhead lines, and is one in which there is considerable divergence in practice and room for improvement. Whether conductors are arranged in the vertical or horizontal plane, or in some triangular formation, the insulators are generally supported on arms more or less horizontal. Whilst the distance from the conductor at the insulator to any earthed part of the supporting structure, other than the supporting arm, can usually be made large enough, the distance to the supporting arm near the insulator depends on the size of the insulator and, in upright types, the length of the spindle or pin—the former is, as already pointed out, a matter for the insulator manufacturer, and the latter can only be reasonably varied within the limits imposed by the strength of a commercially possible supporting arm and spindle. With this limitation the distance from arm to conductor is not too large for many of our common birds to bridge across.

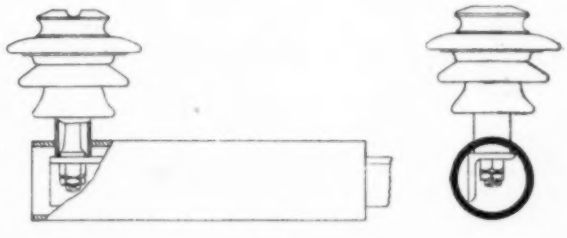


Fig. 3.

The guarding of overhead lines against large birds causing faults to earth has become increasingly more important in this country with the wider use of balanced protective and sensitive earth-leakage trip gear. With ordinary overload breakers the trouble is not so acute, since the fault current through the bird is usually insufficient to operate the switch unless the line is heavily loaded at the time, but with the use of balanced protective gear a much smaller fault current is sufficient to open the switch, its operation being independent of the load.

Bird Guards.

Numerous patterns of bird guards have been tried. Amongst the earliest types was a slab or inverted trough of earthenware made to fit the cross-arm and fixed by wire or other simple method (fig. 1). This type was costly at the outset and expensive in maintenance, as the brittle nature of the material resulted in breakages when up-pole work had to be done.

Frost also accounted for a good many unguarded arms after a winter or two, and more lasting materials

Fig. 4.

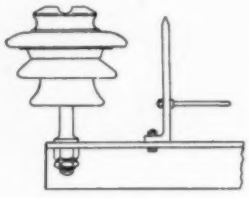


Fig. 5.

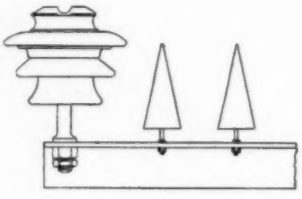


Fig. 6.

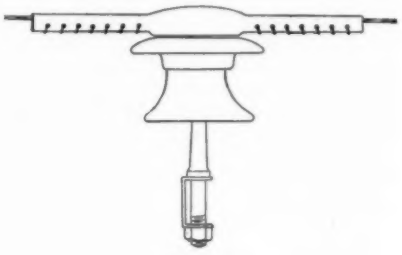


Fig. 7.

were sought. Guards of siluminite, impregnated fibre and other similar materials of various patterns have been used (figs. 2, 3 and 4), one of the best probably being a split tube of impregnated fibre which can be replaced without removing the insulator. Another method of dealing with the trouble is shown in fig. 5. A screen of insulating material supports a perch on which

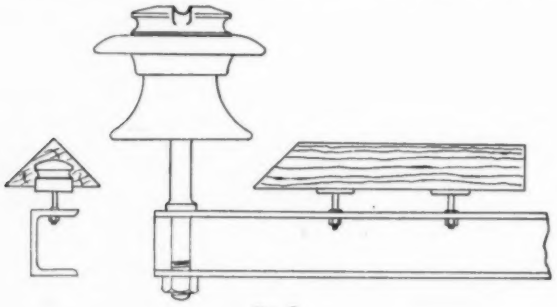


Fig. 8.

the bird must stand to be near enough to the live conductor to touch it. Fig. 6 shows a type of guarding which, when first suggested, was characterised by a well-known engineer as "crowding the poor birds out." Guards of flexible material have been made—these are moulded to fit the insulator top, and fixed by lacing to the conductor for some 18 inches on each side (fig. 7), or are simple sheets lashed round the cross arm.

All the above-mentioned patterns have the disadvantage of comparatively high cost. Hard wood has been considered, and actually used on several lines; the best form of wooden guard appears to be triangular as shown in fig. 8. The birds that usually cause trouble in this country are rooks, jackdaws, magpies, jays, crows, woodpigeons, and also, on the lower voltage lines with small insulators, such smaller birds as starlings, blackbirds and thrushes. Table I shows the average recognised dimensions of a number of British birds.

It will be seen that, apart from the rarer birds, the largest of them, the rook, which is common to all districts, is 19 in. long. This does not mean that the bird in a standing position can reach 19 in., but that from beak to tail, or feet (which ever measurement is greater in any particular instance), the rook measures 19 in., and any line in which there is not a greater clearance than this between the cross-arm and conductor is consequently liable to be earthed by a single bird, and lines in which there is even much greater clearance may be earthed by pairs of birds, one on the arm and the other on the conductor. Pairs of jackdaws have been seen killed in this way, and rooks singly.

The usual clearance between cross-arm and conductor on 6,600-V lines is about 6 in. A bird as small as a starling could, therefore, earth such a line, whilst the clearance to the binder on a 55,000-V line, with upright insulators, is not more than about 16 in., a distance which can be bridged by the larger common birds.

Upright insulators, however, are over the economic border line for such high voltages, and suspension insulators are generally used, resulting in the disappearance of bird trouble. It is clear, therefore, that all lines on which upright insulators can be economically used are liable to bird trouble, but whether the fault

TABLE I.—Dimensions of the Commoner British Birds.

	From beak to feet or tail.	Across outstretched wings.
	Inches	Inches.
Rook, Crow, Jackdaw	13 to 19·5	20 to 27·5
Woodpigeon, Magpie, Jay	14·5 to 18	15·5 to 21·5
Thrush, Blackbird, Missel-thrush. Fieldfare, Nightjar, Woodpecker, Cuckoo	10 to 13	12 to 17·5
Owl	14 to 18	20 to 24
Hawk	14 to 25	19 to 43
Eagle	23 to 34	50 to 54
Gull and Seabirds	15 to 34	24 to 40
Game birds	10·5 to 36	12 to 35
Swan	60	58
Raven	25	36

current is sufficient to trip the switch depends on the voltage of the line and the sensitiveness of the protective gear.

Where wooden bird guards have been used they have been made of beech on account of its close grain and homogeneous nature. Its specific resistance is 690 meghoms per cm. cube dry, and 0.55 megohm per cm. cube wet. The actual resistance of the guard dry or wet is amply sufficient to limit the fault current, even on high voltages, to well within the amount required to operate any protective device, but high-pressure tests show that ohmic resistance alone cannot be relied on. The dielectric breaks down at comparatively low values, and, in addition, surface leakage plays an important part.

Table II and photographic illustrations, figs. 9 to 12, show the results of a series of tests made on actual samples of this type of guard. The pressure was im-

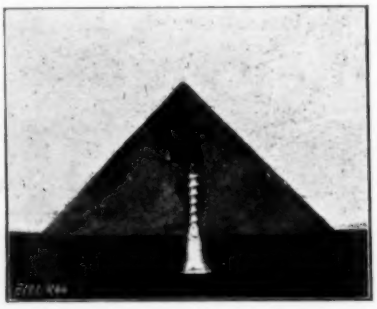


Fig. 9. Punctured to fixing screw in Test I.

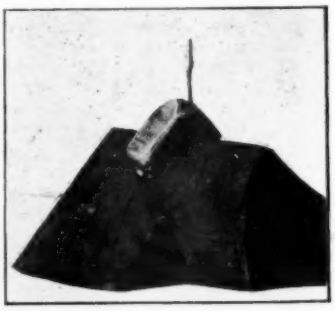
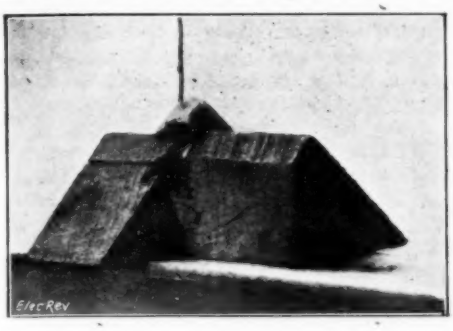


Fig. 10.—Charred Surface and Puncture through knot, Test III.

Figs. 9 and 10.—Sectional Views of Beechwood Birdguards.

posed on the wooden guard through a small metal saddle placed on the top ridge somewhat as a bird would stand, the other electrode being the channel arm. For the protection of the testing transformer, the trip gear was set at 11 A, and fault currents above this value could not be accurately registered. An ammeter included in the fault circuit agreed with the setting of the trip gear, and its readings are of some interest. In nearly all the tests the switch tripped before the ammeter had time to indicate more than 4 or 5 A, but its readings show the comparative rates of increase of the fault currents in the several tests; for instance, the fault current in a test in which the ammeter rose to 3 A was increasing much more rapidly than that in a test where 5 A were shown, and the value reached before the switch opened was probably considerably greater in the former case than in the latter.



Figs. 11 and 12.—Sectional Views of Beechwood Birdguards After Test VIII.

A fault current of 11 A on one phase of a three-phase line represents an out of balance of 209 kVA at 33 kV, 137 kVA at 22 kV, 68 kVA at 11 kV, and 41 kVA at 6.6 kV. Any of these is a sufficiently large disturbance on most lines of normal size to be beyond the desirable limit.

The tests show that the method of fixing the guards by means of wood screws, fig. 9, is bad, and also that after two or three operations the value of the guard is much reduced, a disadvantage that would be increased by the presence of soot, coal dust or other dirt which are liable to accumulate on the surface of the wood in industrial districts. Knots in the wood are also shown to be sources of weakness.

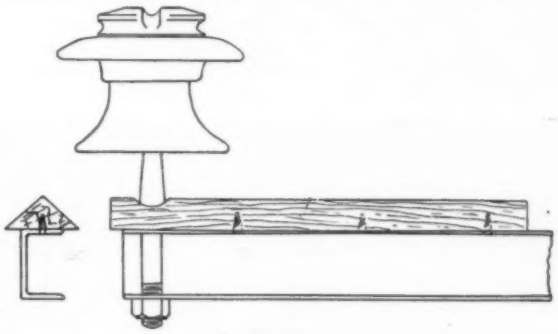


Fig. 13.

TABLE II.—Tests on Creosoted Beechwood Birdguards with A.C. (50 cycles.)

Sample No.	Method of applying pressure.	Test.	Condition of wood.	Maximum k.V. applied	Remarks
I	As described in text. See figs.	*a*	Dry	20	Flashed over surface and punctured to screw. Switch tripped.
		b	Dry	10	Flashed through previous puncture holes. Switch tripped. See fig. 9.
II	As I but without screw or screw hole in wood.	*a*	Dry	20	Flashed over surface. Switch tripped.
		b	Dry	21	Surface scraped clean after previous flash over. Punctured. Switch tripped.
		c	Dry	18	Flashed through previous puncture hole. Switch tripped.
		d	Dry	15	Ditto.
III	As in fig. 12	*a*	Dry	25	Flashed along surface to knot and punctured through knot. Switch tripped.
		b	Dry	19	Ditto. See fig. 12.
IV	As I with hole for woodscrew but no screw.	*a*	Dry	10	Punctured to hole. Switch tripped.
		b	Dry	9	Ditto.
V	As I	*a*	Wet	7·5	Flashed over. Switch tripped.
		b	Wet	7·0	Ditto.
VI	As II	*a*	Wet	7·5	Flashed over. Switch tripped.
		b	Wet	7·0	Ditto.
VII	As II	—	—	—	This sample was soaked in water and left to dry in ordinary room for 7 days.
		a	Dried	25	Flashed over surface. Switch tripped. Ammeter rose to 5.
		b	—	23	Ditto. Ammeter 4·5.
		c	—	22	Ditto. Ammeter 3·5.
		d	Wet	10	Sample now dipped in water for a few minutes and re-tested. Flashed over. Flare maintained and switch did not trip. Switched off after 5 secs. Ammeter over 11 amps.
		e	Partly dried	10	Ditto. Ammeter 8·5 steady.
		f	—	8·5	Flashed over. Switch tripped. Ammeter over 11.
		g	—	7	Ditto. Ditto.
VIII	As II	—	—	—	This sample was soaked in water and left in open air (dry weather) for a week.
		a	Dried	27	Punctured. Switch tripped. Ammeter 4.
		b	—	26	Flashed through previous puncture hole. Switch tripped. Ammeter 4·5.
		c	—	23	Ditto., and punctured in another place. Switch tripped. Ammeter 4.
		d	—	17	Flashed through puncture holes. Ammeter 4·75.
		e	—	15	Ditto. Ammeter 4·5.
		f	—	10	Ditto. Ammeter 3·0.
		g	Wet	5	Sample dipped in water and re-tested. Flashed over and flare maintained. Switched off after 4 secs. Ammeter 10 amps. steady.
		h	Partly dried	5 6	Ditto. Pressure increased to 6. Switch tripped. Ammeter 7·5 amps. See figs. 10 and 11.

Fig. 14.—Herringbone Arms.

Figs. 10, 11 and 12 show the results of tests to demonstrate what would be likely to happen in practice, but in the test the pressure was gradually raised until breakdown occurred. In actual practice the fault current would not be maintained as the bird fell and increased the air gap beyond the length over which an arc would continue, but a large out-of-balance current, even of short duration, is apt to cause very undesirable disturbances on a power system. In several observed instances the bird fell instantly and the flash disappeared as quickly, although the switch remained closed owing, either to the trip gear being set too high, or to there being no trip.

As these tests have shown beechwood bird-guards of this pattern to be somewhat unsatisfactory, a modifica-

tion, as shown in fig. 13, has been tried. The wood, instead of being fixed direct to the pole arm is supported on two small porcelain insulators of the telephone pattern to which it is secured by means of wooden pins. The increase in cost of the mounted guard over that of the " wood only " pattern is small, but the increase in value is large. Tests on this pattern failed to break down the guard, wet or dry, at pressures higher than those for which bird guards are required.

A better solution of the problem, however, is to be found in a modification of the pole arms as shown in fig. 14. The steep slope of the arms renders it difficult for a bird to stand on them, and the clearance to other parts of the structure is sufficient with normal conductor spacing to make bird guards unnecessary for our usual British birds. A conical pole roof, however, is better than the one shown in the illustration. *(To be continued.)*

Glasgow's Electricity Supply.

Official Inauguration of the Second Section at Dalmarnock Power Station.

There was a large gathering of representatives of the electrical industry at the Glasgow Corporation's Dalmarnock power station on Thursday, September 30th, when the official opening of the second section of the station took place.

To visitors to the power station, one of the biggest in the country, the centre of interest lay in the turbine room, where two new Parsons sets had been installed. The turbines are of the standard reaction type, of 30,000 h.p., and exhaust into surface condensers provided by the Mirrlees Watson Co., of Glasgow. The air pumps are of the Mirrlees ejector type. The alternators are of quite standard construction. The alternator cooling is done by external motor-driven fans, and is on the closed system. The alternators are directly connected to step-up transformers made by the Metropolitan-Vickers Electrical Co., Ltd. Three single-phase units, each of 7,800 kVA capacity, form the step-up bank, the ratio being 6,500/20,000 volts.

The motors in the engine room were supplied by the Metropolitan-Vickers Electrical Co., Ltd.

The new boiler-room is equipped with eight Babcock and Wilcox marine-type boilers, the normal full-load output of each unit being 50,000 lb. of steam per hour. There are two stokers per boiler. Four boilers are equipped with Babcock & Wilcox compartment-type stokers, while the remaining boilers have Underfeed stokers.

As in the first and second boiler-rooms, cast-iron economisers have been used, but in the present section the capacity of the economisers has been greatly increased so as to raise the overall boiler-room efficiency. The economisers were supplied by Messrs. E. Green and Sons, Ltd., Wakefield.

The new boiler feed pumps are Messrs. G. & J. Weir's standard turbine-driven type. The principal motors for the boiler-room auxiliaries have been supplied by the British Thomson-Houston Co., Ltd.

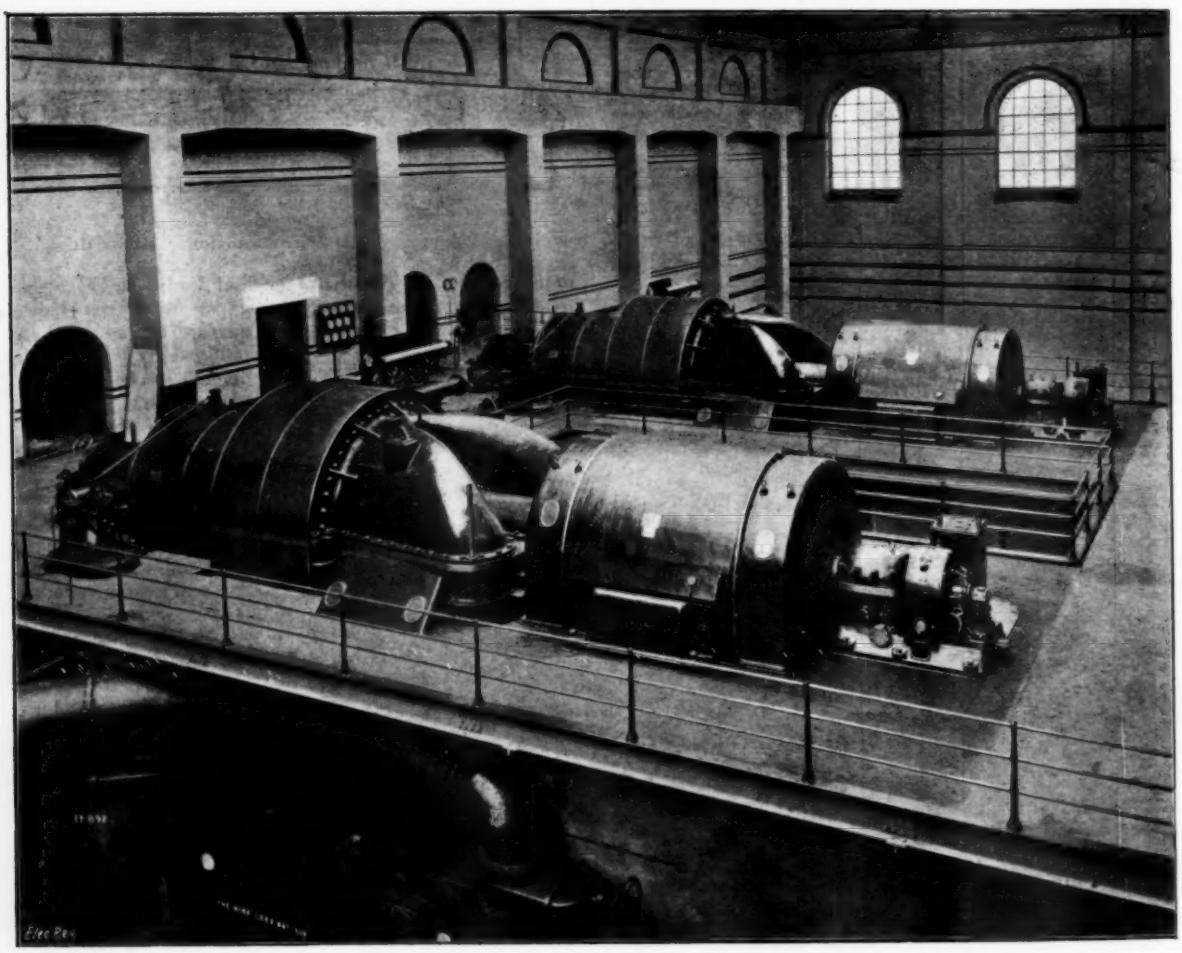


Fig. 1.—Two New Parsons Turbo-generators at Dalmarnock Power Station, Glasgow.

The extensions to the coal-handling plant to supply the new boiler-room have been carried out by Messrs. Strachan & Henshaw, of Bristol. The new coal plant consists of a rotary tippler, capable of tipping wagons of up to 20 tons capacity, a skip hoist, and a distributor.

The additional auxiliary power required for the station is provided by a 1,500-kVA, 20,000/440-volt transformer supplied by Messrs. Ferranti, Ltd.

An account of the extensions was printed in the Electrical Review of June 18th, 1926. The maximum installed capacity of plant contemplated for the site is 200,000 kW. The complete station will consist of a turbine house, four boiler houses, and two switch houses.

At the power station the formal opening ceremony was performed by Lord Provost Sir Matthew W. Montgomery, who set one of the new 30,000-h.p. turbo-generators in motion.

At a luncheon which followed in the City Chambers, Councillor D. MacKellar Dewar, Convener of the Electricity Committee, presided, and representatives were present from many Corporation electricity undertakings, while the various contractors and large consumers were also well represented.

Replying to the toast of "The Corporation of Glasgow," proposed by Councillor Walker, Edinburgh, Lord Provost Montgomery said it was 34 years since the Corporation Electricity Department was started, and to-day they had one of the largest generating stations in the country, with perhaps the lowest rates. His slogan had always been, "Give us cheap electricity," and he believed they might have had cheap electricity but for circumstances over which the Committee had no control. Unfortunately, 10 per cent. had been added just recently to the charges, but he hoped that percentage would soon be taken off and another 10 per cent. as well. The expenditure of the Electricity Department had been £9,319,000, and there had been paid off that large sum by way of sinking fund and depreciation no less than £5,520,000. As regarded future developments, it would be noticed that penny-in-the-slot meters were to be introduced. Referring to the Electricity Bill, his Lordship hoped that whatever effect it might have, it would not arrest in any way whatever the development of such undertakings as that of the Glasgow Corporation.

Sir James Kemnal (managing director, Messrs. Babcock & Wilcox, Ltd.) proposed "The Electricity Committee," remarking that after viewing undertakings all over the world, he could say there was no installation that surpassed in workmanlike construction what they had seen at Dalmarnock. Councillor D. MacKellar Dewar, Convener of the Electricity Committee, replied.

Bailie J. D. Higgins, sub-convener of the Electricity Committee, proposed "The Contractors."

Mr. H. I. Brackenbury, C.B.E. (managing director, Messrs. C. A. Parsons & Co., Ltd.), in responding, said he was sure all the contractors would wish him to say how much they owed to Mr. R. B. Mitchell for his support in carrying out their work. The friendly spirit that prevailed at Dalmarnock had not been surpassed in any other power station in which they had worked. He liked to think of great inventive brains doing their utmost to bring cheap electricity not only to the factories, but also to the poor housewife, to the hospitals, and to the child welfare clinics which, he understood, were being developed in Glasgow. Vast sums had been spent in research work in this country. The cost of making a turbine of the highest efficiency was not small, but England and Scotland had a name for producing the best plant, and he believed that they would retain it so long as the engineers and the great power companies encouraged the study of efficiency, and so long as they were not led away by the attractive and, he thought, misleading cry of low capital expenditure.

Mr. W. W. Lackie, C.B.E., one of the Electricity Commissioners, proposed "The Electrical Engineer and Manager." He said he had known Mr. Mitchell for over 30 years, and had had a long and intimate association with him. It was a real pleasure to him to state that his sterling character, his sound judgment, and his great technical knowledge were ample guarantees that he would continue to command and justify the confidence of the Corporation. Mr. Mitchell had seen the undertaking grow from its modest beginning, and he would be the first to acknowledge that a considerable measure of the success of the undertaking which he controlled was due to the efficiency of the technical staff, which was second to none in the country. He had no doubt that when the trade boom, which was long overdue, came, the usual rate of increase in their output would be greatly exceeded, and another super power station would be required at an early date by the Corporation.

Mr. R. B. Mitchell, in reply, said he had had the pleasure of serving under Mr. Lackie, and no one could wish to serve under a better master. Personally, he would always owe a debt to Mr. Lackie, and he considered the Glasgow Corporation would always remain in Mr. Lackie's debt for the great work he rendered while he was engineer. That day Mr. Lackie had seen the partial completion of the great work which he initiated as far back as the year 1912, and he (Mr. Mitchell) trusted he had been satisfied with what he had seen. The first essential for a power station such as that at Dalmarnock was reliability. Six years ago they made a bad beginning, and he had no doubt that some of their consumers represented there that day would have very unhappy recollections of what took place then. He thought it was true to say that they had during the intervening six years lived all that down. The station had settled down to do hard work, to turn out units, day by day, month by month, units by the million, which, after all, was the primary function of a station. The second essential was efficiency, and in that respect also Dalmarnock stood well in the forefront. They were taking the first place in Scotland among all power stations for efficiency and second place in their class in Great Britain. Proceeding to deal with the extensions, Mr. Mitchell said there was nothing extraordinary about the equipment at Dalmarnock station. They might have been charged with a lack of pioneering, but at the same time they must remember that a station that had nothing extraordinary about it had the advantage of reliability. The lay-out of the Dalmarnock station suited the requirements of a city such as Glasgow. There was still room for extension, but what form that extension would take he could not say at the moment. The proposed 10 per cent. increase in charges was due to the fact that lately they had had to buy supplies of coal at very high rates. In conclusion, Mr. Mitchell referred to the very valuable services rendered by his assistants. They were, he said, an enthusiastic, loyal, and hard-working body of men, and any success achieved was in large measure due to their able assistance.

Smoke Abatement: A Counter Movement.—A number of leading coal distributors have formed an organisation for mutual protection in respect of legislation introduced into Parliament which is said to threaten the interests of the trade. This organisation, which is styled "The Coal Distributors' Parliamentary Committee," will take immediate steps with a view to counteracting the publicity campaign on behalf of gas and electric light interests, which is usually referred to as the "Smoke Abatement Movement." The object of this publicity is to induce Parliament to insert an amendment in the Public Health (Smoke Abatement) Bill, 1926, which, if carried, would have the effect of permitting public authorities to refuse permission for open grates to be built in new houses, the occupiers of which in such event would be forced to use gas or electricity for lighting and heating.

Ericsson Automatic Exchanges.—The Allmänna Telefonaktiebolaget L. M. Ericsson has recently received an order for the construction of an automatic telephone station at Rostov (Soviet Union) for 10,000 subscribers. No fewer than eighteen automatic telephone stations on the Ericsson system are at present under construction, namely, one at Gothenburg, two at Stockholm, eleven in Italy, one at Rotterdam, one at Johannesburg, one at Cracow, and one at Kristiansund (Norway).—*Reuter's Trade Service* (Stockholm).

The First National Radio Exhibition.—IV.

A Review of the Exhibits.

The new receiving sets and accessory apparatus that were revealed to the public for the first time at the show were many and varied, but one would not generally seek novelty in a display of ebonite. The St. Helens Cable and Rubber Co., Ltd., however, exhibited sheet material of unusual effect in that its two sides are differently finished: for example, while one side has the appearance of mahogany, the other may have that of oak, or be black. Again, "sandwich" sheets, though black inside, are "marbled" on the outside in two colours of various shades. Sheets of this new product have a very good appearance, are made in the usual sizes and thicknesses, and designed to reduce the stocks of ebonite it is necessary to maintain.

A component that will probably be prominent in many of the new circuits that will be introduced this season is the screened coil, the merit of which is beginning to be assessed at its true value. By preventing magnetic interaction between the h.f. stages, screening imparts the necessary stability, but it is not easy to make it efficient, for the presence of the screen

Fig. 1.—"Lewcos" Screened Coil.

reduces the effective inductance of the coil; hence it follows that a greater length of wire is required than for an unscreened coil, which means increased h.f. resistance and consequently a greater R/L value, accompanied by loss of selectivity. A feature of the exhibits of the London Electric Wire Co. & Smiths, Ltd., was the display of such coils and h.f. transformers; the "Lewcos" screened coil is made of "Litz" wire wound on an ebonite former, and it has a remarkably low h.f. resistance inside its screen. As shown in fig. 1, a knob is provided on top for handling purposes; the tight-fitting joint of the screen ensures good electrical contact, and two of the sockets are longer than the others, to facilitate plugging-in.

The Metro-Vick Supplies Co.'s receivers and valves were well represented; to the latter has recently been

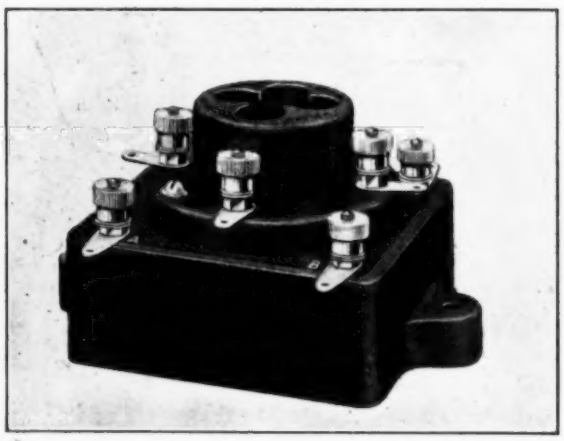


Fig. 2.—"Cosmos" Resistance Coupling Unit.

added the SP.18 "blue spot" and the "short path" SP.55 "red spot" valves, the last-named being amongst the most efficient of the dull-emitters. The 3-valve amplifying panel embodies resistance coupling, and a switch is provided whereby the last two valves may be switched into cascade when it is desired to obtain the greatest amplification of weak signals, or in parallel, if volume is desired. Amongst the new "Cosmos" components, mention must be made of the resistance coupling unit, which can be used when constructing a new set, or to replace a low-frequency transformer and a general-purpose valve in an existing set. When correctly used, it is claimed, this component will form a stage of low-frequency amplification equal to the usual transformer stage with the advantages of pure reproduction and for approximately half the money. It can be used with any valve having an amplification factor of 30, or more, but has been primarily designed for use with a "blue spot" valve, the SP.18 giving an amplification of 35. Other advantages are economy in high-tension battery consumption, the anode current being less than 1/20th of that required generally, and economy in filament consumption. The unit is made is two types, namely, with (fig. 2) and without the spring valve holder.

A new amplifier was exhibited by Messrs. S. G. Brown, Ltd., and also a new "Disc" loud-speaker, circular in shape and 14½ in. in diameter. The large conical diaphragm is entirely enclosed between inner

Fig. 3.—"Brown" Disk Loud Speaker.

and outer protecting cones of metal, the whole being supported as indicated in fig. 3; the front metal part is fashioned in a decorative pattern. The "PQ" type of speaker is essentially a demonstration instrument for use in schools and large buildings, whilst the "Crystavox," which is claimed to operate direct off a crystal set under suitable conditions, embodies two elements in tandem.

A product of Messrs. J. W. Lee & Sons, the "Hedgeland pictorial" loud-speaker is a new departure; it is in the form of a decorative picture to hang on the

wall, and consists of an ordinary frame covered with a coarse canvas-like material, in the centre of which is mounted a reproduction of some well-known oil painting or water-colour. Enclosed in a wood casing at the back is a loud-speaker of the large diaphragm type, which is adjustable by means of a lever; connection is made by ordinary picture wire between two metal hooks, so that when hung on the wall it is almost impossible to distinguish the instrument from an ordinary picture. Apart from its novelty and attractive appearance, the performance of the speaker is surprisingly good.

A new comer of elegant appearance is the "Tangent" cabinet speaker of Messrs. Gent & Co., Ltd. (fig. 4). Its main feature is compactness, the instrument being provided with a 2,000-ohm adjustable diaphragm. The type "D. C. Radiomatic" is a two-valve loud-speaker set, the unique feature of which is the glass door (fig. 5) which folds back into the cabinet in such a manner that it occupies little room; the set is self-contained, provision having been made for accommodating all the

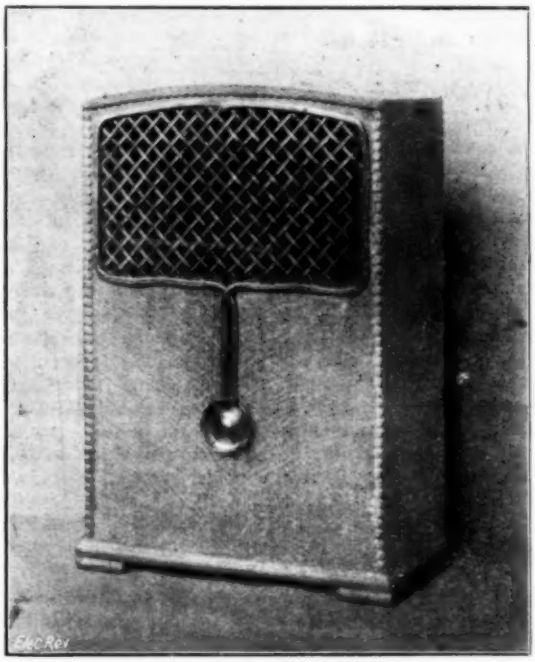


Fig. 4.—"Tangent" Loud Speaker.

three batteries in the cabinet. The company's h.p. plate battery eliminator has been improved to enable it to furnish a greater output at a higher voltage. The rectifying valve and smoothing devices are housed in an all-metal case, and it has an output of from 3 mA at 175 V to 20 mA at 90 V, with a variable detector voltage; for the convenience of the home constructor the essential component parts of the outfit may be purchased separately if desired.

Of outstanding interest was a set exhibited by Radio Instruments, Ltd., by courtesy of the Sudan Government. It is a heterodyne unit receiver designed expressly for use in the tropics, the instruments having been enclosed in steel cases to make them insect- and rot-proof, whilst the components are mounted on Admiralty grade "Paxolin." New model two- and five-valve broadcast receivers were on view, and the "R.I." permanent mineral detector is now fitted with a device for preventing accidental damage being done to the crystals during adjustment. A brass toothed cylinder is attached to the plunger, which engages with a pin each time it is desired to withdraw the crystal for finding a new position; after adjustment, the crystal is automatically locked, so that it is impossible to rotate without withdrawing the crystals from contact. An entirely new pair of "push-pull" transformers was shown for power valves, enabling the power to be split up between two valves, and a balanced circuit is the result, even when large power is to be handled. The transformers are made in pairs, and are different from each other: The first has one primary and two secondary windings, accurately balanced, and is called an input transformer; the second, which has two accurately-balanced primaries and one secondary, is the output transformer. There are, therefore, five terminals on each instrument, instead of four, and it will be seen from the diagram (fig. 6) that the two amplifying valves work together as one, the output of the detector circuit being connected to the primary of the input transformer. Here, the energy divides equally between the split secondary of the second (or output) transformer, the single secondary passing on their united efforts to the loud-speaker. Only half the amount of energy is there-

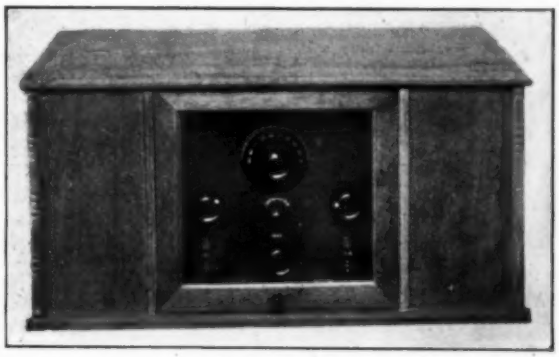


Fig. 5.—"Radiomatic" 2-V Receiver.

fore amplified by each valve, so that there is less possibility of the valve becoming saturated. Any defects in the potential applied to the grids of the valves which might be caused by differences in the iron used in the construction, produce no effect upon the output, because they are present at both grids simultaneously, and one balances out any such defect in the other. Ordinary receiving valves can be used, instead of power valves, and the circuit is peculiarly economical in high-voltage current. A further advantage is that as there is no

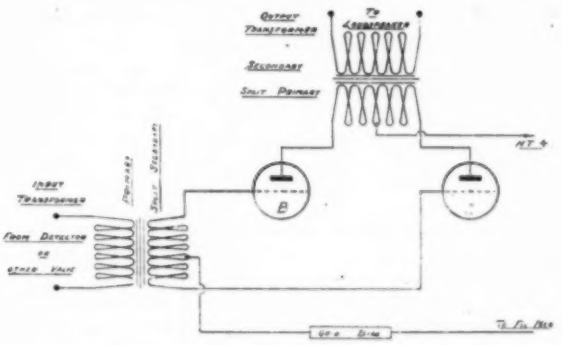


Fig. 6.—"R.I. Push-Pull" Power Amplifier Circuit.

direct-current output in the second transformer, the loud-speaker is independent of polarity. The company has specialised in chokes and is prepared to build them to any value, if desired; and it claims to have sold three-quarters of a million transformers of the standard pattern.

A new battery which has been eagerly awaited for some time made its appearance at the show. A product of Siemens Brothers & Co., Ltd., it is known as the "Super-radio H.T." dry battery, and two features are the exceptional insulation provided between individual cells and their large capacity; the units are solidly embedded in paraffin wax. The battery is made up of 36 cells of extra large size connected in series to give a nominal e.m.f. of 50 volts, its weight being 20 lb. and dimensions (including the substantial lid) 8¾ by 5⅝ by 9½ in. high. Nickelled spring-clip terminals are fitted and tappings give 25 and 36 V, whilst two connecting tabs are provided for use with flexible connecting wires, no soldering being needed. Although the maximum economical discharge rate is given as 20 milliamperes,

that current may be quite safely exceeded without detriment to the battery except that, in the aggregate, the period over which it will function will be somewhat more than proportionately reduced.

The Primus Manufacturing Co.'s h.p. dry batteries are said to be made by a new process which does not involve the use of salammoniac, acid, or manganese, and it is claimed that the cells will revive when used up if they are allowed a period of rest. The Company also produces a two-valve, non-oscillating receiver.

The invention of a Frenchman, M. Gustave Weissmann, "Koda" dry cells were exhibited by Messrs. Sydney Jones & Co., Ltd. Their chief feature is the arrangement of the electrodes. The zinc is bent into "folds," with agglomerate and a carbon rod in each compartment, so that both sides of the metal are brought into active use, increasing the surface area; as the distance between the zinc and carbon is reduced, and the interior of the cell is subjected to a high mechanical pressure, which ensures good surface contact, the internal resistance is lowered. The zinc is not used as the containing box, and, as the electrolyte need not be added until the cell is to be used, it remains inert, and no deterioration can take place during storage.

Reference may be made to the fact that Messrs. Ericsson Telephones, Ltd., celebrate their jubilee this year as manufacturers of telephone and telegraph apparatus. Recently introduced receivers of theirs are cabinet models, and the four-valve set is provided with a wave trap; although the apparatus is mounted on a timber panel, the use of ebonite bushes ensures good insulation.

Adaptive Designing.

The Consideration of Ways and Means.

By FRED. W. DAVIES.

Adaptiveness, ever an essential in the art of designing, is in its larger and more comprehensive aspect becoming of significance as the precedent of economical production. It is no longer sufficient for the design of a generator or motor to be proportioned to meet the specification; it must also be adapted to the means available for its production. From first to last it should be worked out with a view to the capabilities of the drawing office and the pattern shop, to the class and the sizes of the machine tools available, and to the financial resources of the manufacturer. It may be noted in passing that this aspect of designing, though applying in some degree to all electrical manufacturing establishments, particularly affects those works in which the limitations of production are most marked.

The success of any electrical design nowadays depends ultimately upon commercially competitive considerations; the designer's dominant idea, then, must be to facilitate cheap production. It is here that adaptiveness comes into the scheme. It is possible by adaptive designing to reduce the number of drawings, patterns, jigs and formers that will be required for a projected range of machines; to arrange both the mechanical design and the windings so as to make it possible to carry on with the minimum stock of materials; and even to extend the range of sizes manufactured.

Among the more obvious ways of minimising work in the drawing office and avoiding a multiplicity of patterns, may be mentioned the use of the same magnet frame for a d.c. generator and a motor of equivalent size; and, in the case of a.c. machines, the adoption of the stators of the larger-sized induction motors for smaller alternators also. The practice of using the same frame for more than one *size* of machine, though affording a ready means of obtaining intermediate sizes when required, is open to the objection that it involves a departure from the best proportions, and, generally, is not advisable. An exception may perhaps be made in the case of single-phase motors, for which the standard three-phase motor frames are employed; for when the same range of powers and speeds is required, this may be accomplished by lengthening the motor to compensate for the reduced output which would otherwise be obtained.

It is questionable whether the practice of employing bearings of different sizes at the two ends of a squirrel-cage motor is really economical; for though the load is admittedly less at the end remote from the drive, the slight extra cost of fitting both bearings of the larger size is probably more than offset by the economies effected by using identical end shields at both ends. Moreover, in induction motors fitted with ball bearings, the bearing remote from the driving end is usually called upon to take any end-thrust that may be encountered; and even though the rotor be set *exactly* central with the stator, there is the possibility that in actual service an abnormal end thrust may result from such incidental causes as the driving and driven pulleys being out of alignment, an unevenly running driving belt, or other like contingency.

The limitations of the machine shop (perhaps not always taken into account as they should be) have a great and far-reaching influence on the commercial success of any design. The swing of a lathe, or a boring and turning mill, limits the size of the field magnet or stator that can be machined in it; and this fact, no less than any consideration of electrical efficiency, or even of economy of materials, should be given due weight. It is not merely the size of the largest tool in a shop that imposes the limit; it may be desirable that certain sizes should, for local reasons, be dealt with in a particular bay of the machine shop, or under the direction of a certain department. In some sizes, therefore, it may be found advantageous to increase somewhat the length of the magnet or stator, in order that the diameter may be correspondingly reduced. It may even be worth while to make the feet separate, providing machined facings on the magnet or stator to which they may afterwards be secured.

Machining costs are usually lower when work can be arranged to be done in the lathe or the vertical boring mill instead of on the planing machine. An instance of this is afforded by the laminated pole tips of d.c. machines. To machine the seatings for these by planing is a costly operation, necessitating as it does several settings of the work. It is better in every way to machine the seatings by boring, the laminated tips being punched concentrically. Commutating poles may be fixed in the yoke more cheaply, and as effectively, by making the ends of their cores of circular section, holes being drilled or bored in the yoke to receive them. They may be fixed in position either by large nuts on their screwed ends, or by screwed-on plates, or by other approved means.

In the winding shop, also, some simplification may be effected with corresponding economy. In certain cases formers may be made to serve for more than one range of windings; and it may be found that the same former can be used for the winding of both a six-pole stator and a four-pole rotor of the same size of motor frame. Sometimes in an a.c. motor having a special winding there is insufficient room for the end windings; when it becomes necessary either to make special end shields or to modify the form of the stator coils. The ordinary barrel type winding being inadmissible, re-

course may be had to ordinary hand winding, which obviates the need for a special former, and in which less room is required at the ends.

Heavy strip windings for commutating coils and other purposes are usually wound edgewise; this, however, involves the use of a special winding machine, and is a comparatively costly method. A simpler method is to wind the strip on the flat, which may readily be done by making the coil in two sections, half of the required turns being wound in each section. The inside ends of each section are securely connected to an inner shell of copper, and by winding each section of opposite hand, the two outside ends form the terminals of the coil. If bare strip is used, insulation between turns may be provided by winding in with the copper strip a continuous strip of suitable insulating material.

An important point is that of the limitation of stocks—of both raw materials and component parts. Uninterrupted operation and quick delivery can only be ensured by the carrying of adequate stocks of castings, core stampings, standard coils, and so forth; these require not only valuable room for storage, but also a large capital. The designer's part in this problem is to provide designs that will enable the works to carry on with the minimum amount of stock. Some of the foregoing suggestions respecting the mechanical side of the work apply here. On the electrical side, core stampings, coils, and brush gear all have to be stocked in fair quantities, and of these the stampings and coils often prove rather expensive items.

In a range of d.c. machines for different standard pressures, it is convenient to standardise the same armature coils for several pressures, by adopting different connections. In a four-pole machine, for example, a given armature coil winding may be made to serve for 110, 220, and 440 volts, by the simple expedient of using double lap connections for 110 volts, single lap connections for 220 volts, and series wave connections for 440 volts. With a standard design of stamping for any given size of d.c. armature, different windings for the wire-wound armature can readily be arranged by employing a different number of turns per coil; but, in larger sizes, employing bar-wound coils, in which it is obviously out of the question to effect a small variation in the number of turns per coil, there is less flexibility of design, though the number of coils may be varied within wide limits by employing two, four, or six half-coils per slot.

The several speeds of induction motors—particularly three-phase, in which a different number of poles is required for every speed—necessitate the carrying of a stock of stampings for each speed; and when speeds which are off the standard range are specified, the difficulty of effecting quick delivery sometimes becomes acute. The design will, of course, be more flexible if we work with a fairly large number of slots, so to permit of a given design of stamping being used for two or more speeds; but the multiplication of slots has its disadvantages, chief among which is the smaller space factor in the slots. Nevertheless, speeds involving numbers of poles not contemplated when getting out the original design are sometimes required. The difficulty here is not insurmountable; for whilst it is essential that the number of coils should be equal, and the spacing of them symmetrical in each phase, also that equality should be observed in each phase of every pair of poles, there is not the same necessity for symmetry *in each phase of every pole.*

Consider an eight-pole three-phase winding applied to a stator of 60 slots. This would presumably be arranged for 60 former-wound coils, with two half-coils in each slot. We may allot alternately three and two coils per phase per pair of poles, which will give us twenty coils in each phase and five coils per phase for each pair of poles.

As an instance of even greater asymmetry, we might use a 36-slot stamping for the eight-pole three-phase winding if no other was available. In this case we should wind the stator with 36 coils (two half-coils per slot, as before) and arrange alternately two coils and one coil per phase per pair of poles, thus having twelve coils in each phase, and three coils per phase for each pair of poles.

These asymmetrical windings, as we may call them, for which other combinations will readily occur to those familiar with the subject, appear to give a rather better starting torque, due probably to the fact that the irregular spacing of the phases tends to damp out the spacing ripples in the field form of the motor. Theoretically, they have the objection that with them the rotor losses will be greater, though actually the decrease in efficiency is negligible—at all events where the number of coils per phase per pole does not vary by more than, say, 33⅓ per cent. The wider variations are naturally more open to the objection. These departures from more conservative practice afford a ready means of adapting a special winding to a standard stamping; and in the case of rewinds they sometimes make possible a speed that would otherwise be out of the question.

It is necessary, in order to meet present-day competition in price, to eliminate such features as have through some fundamental innovation in design become superfluous, or which experience has shown to be unnecessary. A case in point is the provision of adjusting gear for brush rockers on d.c. machines of the commutating-pole type. The brush position being fixed in these machines, there is no need for further adjustment once the best position has been determined on the test bed; and it is probable that, with the universal adoption of the commutating-pole design, the old style of rocking gear will ultimately be abandoned, except for the larger sizes of machines, which, being more cumbersome, may still be fitted with some simple form of brush-rocking gear as a means for obtaining the correct original setting of the brushes.

The provision of brush-lifting gear for slip-ring motors involves an outlay altogether incommensurate with the small advantage which results, and leaves one wondering why such a device was ever thought of. The brush friction on these motors is negligible, and the wear of them (if of the copper-carbon variety usually employed) hardly worth considering. Certainly, the extra cost of brush-lifting gear—to say nothing of its liability in course of time to develop lost motion—is not offset by the small advantage obtained. The same criticism, however, does not apply to short-circuiting gear for the slip rings: this is really necessary, as it cuts out the losses due to the resistance of the brushes, and of the rotor leads (which, if the rotor starter is located some distance from the motor, may be of some magnitude).

The foregoing examples of the modification of the design to satisfy the exigencies of manufacture, the adaptation of it to the limitations of the workshop and the stores, and its adjustment to meet present-day competition, obviously do not exhaust the possibilities of adaptive designing, but may prove suggestive to those interested in the subject. The designer is to-day more intimately concerned with the pressing problems of finance, manufacture, and competition than ever before, and the solution of his particular problem is to be found in the direction of adaptive designing.

Long Submarine Power Cables.—A New York correspondent of *The Times Trade and Engineering Supplement*, says that three 33,000-volt submarine cables have recently been laid under the Mississippi River between the Cahokia plant of the Union Electric Light and Power Company at East Street, Louis, Ill., and the west bank of the river. A "record" for length, size, and weight of high-voltage lead-covered and armoured submarine cable manufactured and installed in single lengths is believed to be established by this installation. The cables, which were manufactured by the Standard Underground Cable Company in lengths of 2,500 ft., weigh over 27 tons and are approximately 4¼ in. in diameter. Shipment was made on specially constructed iron reels weighing 5 tons each, making the gross shipping weight for each length in excess of 32 tons. Before the production of these cables the maximum length that could be manufactured was approximately 1,200 ft. A splice in midstream was accordingly necessary, and 21 cables of two lengths each had previously been installed at this point. The company proposes to lay 24 more of the 2,500 ft. single-length cables during the next three years, making a total of 48 cables at the Cahokia crossing.

D

Fireproof Insulating Material for Electric Heating Appliances.

By GUSTAF NYMAN.

In the electrical industry there is frequently a need for insulating material for quite a number of appliances which, besides having great strength from the mechanical and electrical points of view, also possesses great heat-resisting properties. I am, in the first instance, thinking of electrical flat irons, cooking apparatus of various kinds, electric stoves, switches, regulating resistances, &c., for electrical plant. In many cases mica is being used, but this material is rather expensive, and sometimes it is impossible to obtain pieces of mica with large enough surfaces. For painting or coating for staying purposes in the case of resistance spirals and such like, some manufacturers make use of an insulating material which, after drying, forms a fairly hard substance. I have been told, and have also chemically proved, that this insulating substance consists of pot-stone powder, puddled in a water-glass solution. But those firms who are using such an insulating substance for electrical apparatus and appliances, which are subject to great variations in temperature, complain that the insulation in the course of time becomes far from satisfactory from an electrical point of view. On making investigations I have discovered that the insulating material gradually becomes coated with a woolly substance. Chemical analysis has proved that the latter consists of a mixture of acid and neutral carbonate of sodium. As the insulating material is comparatively porous, this development of carbonate is also able to proceed within the insulating material itself, and the result is the cracking of the insulation.

It is a substitute for this insulating material of pot-stone and water-glass solution that I wish to describe here, and recommend for use. With finely-powdered chalk and a small quantity of pot-stone powder, puddled in a water-glass solution, we obtain, after drying and proper heat treatment, a porcelain-like insulating substance which possesses great strength from both the mechanical and the electrical points of view. The proportions of chalk, pot-stone powder, and water-glass are naturally not of secondary importance. In order to ascertain the best and most suitable composition for the insulating substance, quite a large number of tests have been carried out with resistance spirals and such objects, coated with the insulating substance in conformity with several recipes. These tests have gone to prove that the durability of the insulating material varies considerably in the case of different proportions of chalk, pot-stone, and water-glass, as well as the periods for drying. What may really be considered to affect an insulating material are (1) variations in temperature, (2) moisture, and (3) carbonic acid in the air. The insulating material has been tested with regard to this. Even in an atmosphere permeated with fumes from nitric acid and sulphuric acid baths, tests have been made upon the insulating material.

With the guidance, and on the basis, of the thorough tests thus carried out for ascertaining the best and most suitable composition, I have arrived at the following proportions:—10 lb. finely-powdered chalk; 1 lb. pot-stone powder; 11 lb. water-glass with a specific gravity of 1.36. The chalk and pot-stone powder should first be thoroughly mixed together, preferably with a mixing machine or a grinder, so that any lumps that may be present in the chalk or pot-stone powder are crushed. After that, add the water-glass solution. The mass may then be diluted with water to obtain a suitable consistency for putting on with a brush or spatula. More water than is absolutely necessary should, however, be avoided, as in such cases cracking easily occurs. After putting on a coating of the insulating substance it should be allowed to dry at ordinary room temperature for 12 hours. After drying, the substance should be stoved at about 90 deg. C. for at least 12 hours. The presence of the pot-stone powder prevents cracking; an insulating substance made only from chalk and water-glass has a great tendency to crack. If the drying periods ascertained by the tests are not adhered to, good results cannot be expected. In contradistinction to an insulating substance dried at a higher temperature, that dried at a temperature prevalent in a room is not very resistant to water and easily crumbles to pieces.

As the insulating material also possesses great mechanical strength, it can be used for insulating plates subject to comparatively high pressure.

South African Notes.

[From Our Durban Correspondent.]

It is interesting to note that the larger generating stations in South Africa are gradually taking over the supply of electricity to the smaller towns, thereby closing down the small inefficient plants and supplying energy at a much lower rate than was previously the case. The latest township to decide to take a bulk supply is Paarl, in the Cape, which it is hoped will be in a position to take supply towards the end of 1926 and pending the completion of the S.A. Electricity Commission's station at Salt River, energy will be supplied by the Cape Town Municipality; good progress has already been made in the erection of the transmission lines. Heidleburg, in the Transvaal, is also making arrangements to take supply from the Victoria Falls Power Co., and in Natal, Glencoe has recently become connected to the supply of the S.A. Electricity Commission's power station at Colenso.

Developments in Durban.

The intensive electric cooking campaign recently launched by the Durban Corporation is bearing good fruit, and in August there were 138 stoves and 79 bath heaters connected to the mains, and a heavy demand is anticipated during the next few months. The system of distribution is being largely reinforced in consequence, and many extensions are in hand for the ever-growing demand for motive power, &c. A 6,600-V line is now being erected a few miles out of Durban for the supply of electricity for irrigation purposes on the Natal Estates Sugar Co., at a cost of £1,450.

A supply of energy is also being arranged for the Clairwood Quarries, five miles out of Durban, at a cost of £850. A wool washery at Umlaas, near the south coast, is also contemplating a supply, the cost of supplying being estimated at £1,750.

In addition to these power requirements an extension along the main suburban route has been decided on, the latest suburb being Northdene, approximately 13 miles distant. The capital cost of this scheme is estimated at £5,100, and will be proceeded with as soon as the necessary guarantees have been received. A new suburb belonging to the Durban North Estates, Ltd., has also concluded an arrangement with the Durban Corporation for lighting and domestic supply on the company's agreeing to an annual return of 20 per cent. in revenue on the capital expenditure, the unit charge being 7½d. up to a minimum of 15s. per month and one penny thereafter. With this steady growth, it is not surprising to note a largely increased sale of energy, and it will probably be found that Durban now heads the list of South African municipal stations in this respect, as for the year ended July last the total energy sold amounted to 55,844,166 kWh.

Metal-clad Switchgear.

A very interesting lecture was recently given to the Natal Institute of Engineers at Durban, by Mr. H. W. Clothier, of Messrs. A. Reyrolle & Co., Ltd. The lecture was well illustrated by lantern slides as well as a kinema film, and was listened to by a large and appreciative audience. Mr. Clothier sketched the development of switchgear during the past 40 years, and the slides clearly showed the engineering "griefs" that had been experienced by fire, &c. A good case was made for the metal-clad type of switchgear, and it was very interesting to learn that British engineers had led America in this direction.

Manchester Civic Week.—The Lord Mayor, the Rt. Hon. Miles E. Mitchell, formally inaugurated Manchester's "Civic Week" with an address which was broadcast; a musical entertainment on Sunday, October 3rd, was also broadcast. The Post Office authorities staged an exhibit which was divided into a cable section, wireless section, telegraph and telephone apparatus sections, and a section illustrating the development of underground ducts, manholes, &c. One of the first telephone exchanges was opened in Manchester, having been preceded a few months only by one in London in the same year, 1879. Mr. W. J. Medlyn, M.I.E.E., superintending engineer, states that in the Manchester municipal area there are now 26,500 exchange lines fitted with 47,000 telephones.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.—Mr. A. F. Harrison (City of London Electric Lighting Co., Ltd.), presided at a meeting held under the auspices of the London and Home Counties Committee in the "Wiring the Homes of Britain" campaign, at the Electric Restaurant, Ludgate Hill, E.C., on October 1st. The chairman explained that the meeting consisted of representatives of electricity suppliers, electrical contractors and manufacturers in the area, which extended from Norfolk to Portsmouth. Four of those meetings were being organised for the North, South, East and West of London in which districts separate sub-committees were working. The principal object of those sub-committees would be to form "Circles" in all localities. Mr. Harrison then explained the scheme, emphasising the fact that the prospective competitor in the ballot had actually to go to a contractor's or other showroom to secure the explanatory booklet. The sales of the latter had already reached half a million and a similar quantity was in the press. The success of the campaign, he said, was mainly in the hands of the contractors and supply authorities with showrooms.

Mr. J. W. Beauchamp drew attention to the model of the prize electric home which was on view in the room, and then said that the whole of the area committees had been formed and were well on with the work. He wanted to make sure that every contractor or supply authority was in a position to provide the booklets to the public. He referred to the local "Circles," which were informal committees formed to do their best to further the scheme. That could be done best by talking of the scheme in and out of season. He urged contractors to adopt the standard shop-window "fit-up" month by month. The next thing was to organise exhibition houses which could be fitted up easily and cheaply as had already been proved. For the first time they had a means of causing the whole industry to move *en masse* towards one common object. Local advertising, keying up with the national advertising, was most valuable, and local circles should endeavour to run advertisements, stereos for which could be obtained at a low price from E.D.A. They should not be deterred by the coal dispute; in fact, it might even be turned to good account.

Mr. Buckle (G.E.C.) suggested that contractors should arrange a display of the lighting fittings depicted in the competition booklet, and said that their window displays should connect up with the competition with the coloured poster depicting the house in a prominent position. The work of the local "Circles" would no doubt be heavy for the first four or five weeks, but after that it would only be necessary for them to stir matters up if they became stagnant. This speaker also emphasised the great value of local advertising, and considered that it should be possible for members of "Circles" to penetrate into the societies which existed under various names in every town. After 20 years' experience, he was convinced that the model house was absolutely the best method of advertising electricity; builders and furnishers were only too anxious to lend houses and furniture.

Mr. Dale said that there were already over a hundred potential local "Circles" and demonstration houses were being opened in West Hartlepool and Tansey, and an electrical flat had been arranged in Croydon. In addition, 100 electros for local newspaper advertisements had been sold.

Following this a number of speakers asked questions regarding the scheme, and briefly mentioned what had already been done in their districts. Others expressed their determination to push the scheme along by the formation of "Circles," &c.

A mass meeting of people engaged in the electrical industry was held at Paisley on September 30th, when the scheme was explained by Mr. Hughes, of the Glasgow Lighting Service Bureau.

E.D.A. Conferences.—As we briefly announced in our last issue, the 1926-27 series of Conferences organised by the British Electrical Development Association commences on October 15th, when Mr. V. W. Dale (E.D.A.) will open a discussion on "Wiring the Homes of Britain." Further arrangements are as follows: November 19th, "Shop Window Display," speaker Mr. E. Willson, chairman Major H. C. Palmer; December 17th, "Secrets of the Selling Art," speaker Mr. G. S. Francis, chairman Mr. P. J. Pybus, C.B.E.; January 21st, 1927, "Industrial Heating," speaker Mr. S. E. Monkhouse, M.I.E.E., chairman Mr. R. W. L. Phillips, A.M.I.E.E.; February 18th, "Assisted Wiring Schemes," speaker Mr. W. F. T. Pinkney, M.I.E.E., chairman Mr. E. Slater, M.I.E.E.; March 18th, "Refrigeration," speaker Mr. L. R. Morshead, chairman Alderman Duncan Watson, M.I.E.E. This year's meetings are being held at the Royal Society of Arts, John Street, Adelphi, and light refreshments will be served during the intervals between papers and discussions.

Contractors Visit "Osram" Works.—On September 15th a party of members of the Sussex and East Kent sections of the Electrical Contractors' Association paid a visit to the Osram Lamp Works. Mr. F. P. Driver occupied the chair at a luncheon given by the company, and Messrs. H. L. Smith and Watts, chairmen of the Sussex and East Kent sections respectively, thanked the General Electric Co., Ltd., on behalf of the visitors. After viewing the lamp works, the party proceeded to the glass works at Wembley, going from there to the G.E.C. Research Laboratories.

Electric Furnace Contracts.—Orders recently received by the Electric Furnace Co., Ltd., London, include the following:—A 3-ton Héroult electric furnace for H.M. Dockyard, Portsmouth; a 95-kVA resistance furnace for annealing, for Japan; and an Ajax-Northrup high-frequency furnace for South Africa.

Large Contract for B.T.-H. Company.—The Coventry City Council decided on September 28th to confirm the recommendation of the Electricity Committee to place a contract with the British Thomson-Houston Co., Ltd., Rugby, for the whole of the initial installation for the new power station which is ultimately to contain five or six 18,750-kW continuous-maximum rated turbo-alternator sets, with the necessary step-up transformers, switchgear, boiler-house equipment, coal- and ash-handling plant, buildings, &c. The first installation will include:—Two 2-cylinder turbines, running at 3,000 r.p.m., designed for 325 lb. gauge pressure, and 700 deg. F. temperature, coupled to alternators, each having a rating of 23,400 kVA, 6,600 V, 3-phase. The whole of the work is to be carried out to the specification of the city electrical engineer and manager, Mr. G. Tough, O.B.E., M.I.E.E.

Switchboards for a Film Studio.—With reference to the recent outcry for British films, it is interesting to note that the new studio built at Elstree for the British National Pictures, Ltd., was supplied with switchboards by the Park Royal Engineering Co., Ltd., to the order of Messrs. J. B. Marr & Co. The main sub-station switchboard, which is not yet fully equipped, will eventually consist of 26 panels, whilst in each of the studios (eight of which will be erected) a 5,000-A capacity board controlling the lighting circuits will be installed, although at present only one has been completed.

The Value of Advertising.—Mr. J. H. Carmichael, of Manchester, told a gathering of Lancashire Rotarians, last week, that advertising was the most efficient, economical and convenient of all propaganda. To-day it was unrivalled for buying and selling. It was a powerful instrument in the concentration of public opinion, promotion of interest, exchange of ideas, and broadcasting the usefulness of production and service. Advertising had assisted discrimination between branded and guaranteed goods and substitutes. Profiteering was not possible with advertised goods. Advertising had done more to mould habits and nourish minds and ambitions than any other force. It had awakened desires undreamed of 25 years ago. It had encouraged taste and given focus and strength to a desire for better environment.

Unemployment.—There was a further decrease in unemployment during the week ended September 20th, the number at that date being 1,532,400, as compared with 1,551,924 a week earlier and 1,311,958 on September 21st, 1925.

British Radio Exports.—The *Wireless Trader* recently published details of the exports of radio apparatus from this country during the first six months of this year. The total value was £645,194, including valves valued at £72,329. Re-exports amounted to £19,110 (including valves £3,094). By far the largest importer of British radio goods was Australia, whose share was valued at £139,560 (valves £14,653). Japan was next with goods valued at £108,756 (valves £11,470). Goods worth £40,384 were exported to the Netherlands.

British or German Meters.—Heated debate took place at the Elland U.D.C. meeting last week on a recommendation of the Finance Committee that meters for electricity be purchased from English firms. Mr. J. Gregory, moving the reference back of the minute, said, whilst the meters suggested would cost £2 12s. 6d., other Councils were buying meters at £1 12s. 6d. He alleged that British prices were inflated by a "ring," and that the purchase of English meters did not, as was generally assumed, necessarily mean more employment for British workers. In the course of the discussion on British meters *versus* German meters, one speaker, opposing Mr. Gregory, said "British goods for British people every time, and to Hell with the Germans!" The chairman said he himself would not have German goods if they were given. The German Government, he said, was subsidising engineering firms so that they could dump their goods into this and other countries, while the workers there had longer hours and less wages than here. Mr. Gregory retaliated by suggesting that British engineers were dumping goods in other countries. On a division the voting was equal, and the chairman gave his casting vote for the minutes—for British meters only.

Recent Contracts.—Among the orders recently received by member firms of the British Engineers' Association (Inc.) are the following:—Messrs. Petters, Ltd., two 36-42-b.h.p. engines for driving B.T.-H. generating plant in the Indian training ship *Dalhousie*; Messrs. Mavor & Coulson, Ltd., orders from the United States for their electrically-driven jigger-conveyor equipment; Messrs. Gwynnes, Ltd., 33 sets of electrically-driven 8-in. sand pumps for the Suppur Barrage Scheme, India, the electrical sub-contracts being carried out by the English Electric Co., Ltd.; and the Automatic Telephone Co., Ltd., a colliery-winding signal indicator of record capacity for the Silksworth Colliery, Durham, and automatic and remote-control gear for the Wellington (N.Z.) Tramways, the Bombay, Baroda and Central India Railway Co. and others.

Correction.—In our "City Notes" for August 20th it was stated that the Soc. Ercole Marelli, of Milan, were the makers of Marelli magnetos. This was an error. Messrs. Ercole Marelli & Co., S.A., Milan (who are represented in this country by Messrs. Marelli & Co., Ltd., of 19 and 20, Garlick Hill, E.C.4) do not make magnetos; these are made by Messrs. Fabbrica Italiana Magneti Marelli, who are represented here by Messrs. Marelli Magnetos (England), Ltd., of Wells Street, Oxford Street, W.

Venezuelan Duty on Radio Apparatus.—The *Board of Trade Journal* states that certain modifications have been made in the Venezuelan Customs tariff. Radio apparatus and accessories are now subject to an import duty of 5 cts. per kg. It is to be noted that, in addition to this, there is a surtax amounting to 56.55 per cent. of the duty.

Radio Exhibits at Selfridge's.—An interesting exhibit was recently "staged" at Messrs. Selfridge's, Oxford Street, by the Mullard Radio Valve Co., Ltd. This took the form of a valve factory in miniature, in which the following operations were demonstrated: Grid winding and welding, anode stamping, testing, marking, and boxing. In addition, large pictorial cards were mounted at the back of the stand, showing all the other operations through which a valve has to pass. The company also exhibited types of all its valves, and technical representatives of the company were in attendance to answer the numerous inquiries made by visitors to the display, which is illustrated in fig. 1. During the same period one of the windows of the premises was arranged to display the "Osram" valves and "Gecophone" receiving sets, components and accessories made by the General Electric Co., Ltd. The main features of the window were two ornate cabinet sets and an 8-valve "super-het." receiver. A view of the window is given in fig. 2.

Fig. 1.—Valve-making at Selfridge's.

Fig. 2.—A G.E.C. Window at Selfridge's.

German Electrical Enterprise in Spain.—The report of the Siemens-Schuckert Industria Electrica, S.A. of Madrid, states that despite the general economic crisis in Spain it was possible for the company to attain a record turnover in 1925. Remunerative activity was provided through the extension of existing electricity works and the establishment of electrical working in old and new works, while the railway and tramway department also participated satisfactorily in public contracts. In anticipation of the development of business the works site in Cornella has been almost doubled so as to provide for extensions. The net profits last year amounted to 434,000 pesetas, permitting of the payment of a dividend at the rate of 8 per cent. on the share capital of 4,500,000 pesetas, this rate having been maintained since 1921.

Irish Free State Electrical Imports.—The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports for the first six months of the current year, with a comparison with the corresponding period of 1925. From these we have compiled the appended table showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom as country of shipment, but not necessarily of manufacture:—

	Totals Six Months		U.K. Share.	
	1926.	1925.	1926.	1925.
	£	£	£	£
Electric wire and cables	50,472	51,516	28,380	42,209
Telegraph and telephone instruments and apparatus	22,575	16,956	18,644	16,769
Electric lamps and parts	24,636	22,830	21,920	22,443
Batteries and accumulators	16,194	12,429	14,517	11,751
Radio sets and parts	58,602	23,035	56,284	22,373
Other electrical goods and apparatus	48,935	32,378	29,297	30,599
Electrical generators	19,782	6,445	3,858	6,050
Electric motors	22,751	13,549	14,076	13,353
Other electrical machinery	40,459	33,591	30,238	32,013
Totals	£304,466	£212,729	£217,214	£197,560

It will be seen that, with the single exception of electric wires and cables, the importation of all classes of goods showed a marked advance over 1925, the total of £304,466 representing an increase of £91,787. All but £87,252 of the goods came from ports of the United Kingdom and of this balance, £78,640, is credited to Germany, £201 to Switzerland, and the remainder to other countries.

For Sale.—Southport Corporation Electricity Department has for disposal one 1,000/1,200-b.h.p. Belliss-Morcom triple-expansion engine, direct coupled to a 700-kW single-phase alternator, the extension of the shaft is coupled to a 200-kW Bruce Peebles d.c. generator; Lancashire boiler, superheater, valves, &c. The City of Nottingham Electricity Department invites offers for three 5-ton Clayton steam tipping wagons. Messrs. Penningtons will sell by auction on October 13th, at 414, Richmond Road, Richmond, the stock of a wireless contractor. (See our advertisement pages to-day.)

A World Electrical Trust?—A further report on this question comes from Amsterdam. It is to the effect that efforts are being carried on by the Belgian financier M. Lowenstein for the combination of international electrical manufacturers, it being alleged that the efforts are approaching a conclusion. The parties interested are said to be the General Electric Company of New York, the Royal Bank of Canada, the Insull group of Chicago, and probably the Robert Fleming interests in England. These alleged movements are claimed to be the first step towards the formation of a world electrical trust.

The Metric System in Russia.—A decree published on September 24th renders compulsory the use of the metric system in Russia, especially in wholesale and retail business, as from January 1st, 1927. Up to the present this system has only been adopted in State transport and certain industries.—*Reuter's Trade Service* (Moscow).

British Export Trade.—A correspondent to *British Industries* deprecates the pessimism which characterises many articles upon our post-war foreign trade which appear in the newspapers. He considers that not only is much of it unjustified, but it tends to create a bad impression in foreign countries, and is directly detrimental to export trade. He proceeds to show that the British electrical industry, at least, is very much to the fore abroad. Practically all important electric traction contracts outside Germany and the United States have been secured by British firms; British power plant has competed successfully in all parts of the world; in switchgear Great Britain has been a pioneer, especially in ironclad gear, which is being increasingly used throughout the world; and in many other departments wonderful headway has been maintained. There exist facilities in Great Britain unsurpassed anywhere in the world for the production, installation, and putting into service of all kinds of electrical apparatus.

Australian Contract Litigation.—As we recently reported, the Commonwealth Government and the Federal Attorney-General have applied to the Australian Courts for an injunction to restrain the Australian Shipping Board from proceeding with the execution of a contract for power plant awarded it by the Sydney City Council. A demurrer was lodged by the Shipping Board and the City Council, the Board claiming that it was empowered by a part of the Act constituting it to carry out work of the nature in question. The demurrer was overruled by the High Court, the plaintiffs submitting that the part of the Act referred to was *ultra vires*.

Kalgoorlie Power Supply.—The Perth (W.A.) correspondent of the *Financial Times* says that the report has been issued of the special Committee appointed to inquire into the Government's proposal to assist the Kalgoorlie gold-mining industry by a reduction in costs through the provision of cheaper electric power. The Committee's conclusion is that the only practicable means of establishing a satisfactory power station is for the Government to install and operate it. The State mining engineer, who was a member of the Committee, adds that the advantages to the State of maintaining a producing centre of the magnitude of Kalgoorlie would, in his opinion, justify the estimated outlay of £227,000 on such a station. The Government is considering the Committee's recommendation and will give its decision at the earliest possible date.

Battersea Electricians' Wages.—The Battersea Borough Council last week decided not to make the reduction of ½d. per hour in the wages of the employés in its Electricity Department, which became due on July 1st.

Electricity at Morecambe.—In the trades procession in connection with the recent annual autumn carnival, the Morecambe Corporation Electricity Department had an attractive vehicle containing all kinds of electrical appliances. "Cut the work out of housework" and "For brighter homes—electricity" were "slogans" blazoned on the sides of the vehicle.

Trade Announcements.—MESSRS. A. G. & H. SIBTHORP, of 62, High Street, Hornchurch, and Station Approach, Upminster, have opened an electrical department under the name of A. G. & H. Sibthorp & Green.

THE COMMERCIAL TELEPHONE & ELECTRICAL CO., LTD., has removed to 9 and 10, Railway Approach, London Bridge, S.E.1.

The head office and works of INDUSTRIAL COMBUSTION ENGINEERS, LTD., are now at 31-37, Wybert Street, N.W.1.

The telephone number of MESSRS. HOBDELL, WAY & CO., LTD., has been changed to "Royal 8022," four lines.

With reference to the acquisition of the business of British Electric Vehicles, Ltd., by Messrs. WINGROVE AND ROGERS, LTD., mentioned in our issue of September 24th (p. 502), Messrs. Wingrove & Rogers notify us that for the South of England they have opened a London office at 63, Queen Victoria Street, E.C.4, in charge of Major G. D. Ozanne, A.M.I.E.E., who has joined them from the Radio Communication Co., Ltd., where he was manager of the Broadcasting Department, and Mr. N. E. BAYLIFF, who has hitherto represented British Electric Vehicles, Ltd., in the district.

MESSRS. S. G. LEACH & CO., LTD., state that they are the sole distributors of the "Gleam" quick-service fuse-wire holder (recently described in the ELECTRICAL REVIEW) for London, South, South-East, and South-West England, Birmingham, and export.

The NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. has opened new offices and showrooms at Shenley Road, Boreham Wood, Herts.

VICTORIA ELECTRICAL SUPPLIES, electrical engineers and lampshade specialists, have opened new premises at 4, The Exchange, Queen Street, Deal.

MR. E. P. PRIOR, agent in Ireland for a number of well-known electrical manufacturers, has removed his offices and stores to College Square North, Belfast.

MESSRS. A. & B. HARRIS, LTD., have removed to 47, Victoria Street, London, S.W.1.

The business formerly carried on as the ZENITH MANUFACTURING CO. has been incorporated as a private limited liability company under the title of the ZENITH ELECTRIC CO., LTD., in order to provide additional capital and facilities to cope with increased business. All assets and liabilities will be taken over and the business will continue under the same management and staff.

Catalogues and Lists.—MESSRS. FALK, STADELMANN & CO., LTD., 83-89, Farringdon Road, E.C.1.—Catalogue No. 573, a very comprehensive price list of radio receiving sets, components, and accessories. Also Catalogue No. 575, illustrating and describing "Lucifer" electric pocket lamps and torches.

WELCO PATENTS, LTD., 6, Dowgate Hill, E.C.4.—A photographic postcard illustrating an example of store racks of slotted steel construction.

STANDARD TELEPHONES & CABLES, LTD., Connaught House, Aldwych, W.C.2.—A well-printed illustrated brochure containing a full description of the "Standard" public address system.

MESSRS. WOOTTON & CO., LTD., High Street, Ponders End, Middlesex.—An illustrated price list of meter boards, back boards, wood switch boxes, accumulator crates, and other woodwork for electrical uses.

THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A mailing card bearing illustrations in colour of the company's showcards advertising "Hart" radio and automobile batteries.

THE BRITISH EBONITE CO., LTD., Nightingale Road, Hanwell, W.7.—An illustrated booklet and a price list dealing with "Becol" black and grained ebonite panels and radio components.

THE WARDLE ENGINEERING CO., LTD., Elsinore Road, Old Trafford, Manchester.—An illustrated and priced sheet advertising "Workslite" reflectors for industrial lighting.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—Folder No. 3,760, containing details and prices of "Elasta" vacuum and gasfilled lamps. Also an October blotter.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Catalogue 650, dealing with "Siemens" dry batteries and Leclanché cells for radio purposes. Priced. A great deal of useful data relating to dry batteries is included.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Pamphlet H.4,128, containing an illustrated description of "Magnet" electric cooking equipment for hotels, institutions, and industrial purposes; and Leaflet O.S. 4155, advertising the new 60-W "Pearl" internally-frosted gasfilled lamp. Priced.

THE BASTIAN METER CO., LTD., 58, Haymarket, S.W.1.—Leaflet 14/46-47, advertising the company's "Tabernacle" and "Imperator" electric heaters. Priced.

MR. J. MILLET, 39, Farringdon Road, E.C.1.—A price list of electrical and radio accessories.

ENA ELECTRICAL APPLIANCES, LTD., 62, Englefield Road, N.1.—A priced and illustrated booklet dealing with "Ena" electric fires and hot-plates.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—List No. 169, describing the company's electrometers and photoelectric cells; p. 9 contains in a concise form information regarding the sensitivity of all the electrometers included in the list, and p. 12 presents a bibliography of electrometers and photoelectric cells.

THE SLOAN ELECTRICAL CO., LTD., 8, 10 and 12, Golden Lane, E.C.1.—A pamphlet illustrating and describing the "Anchorlite" portable and adjustable lamp. Priced.

MESSRS. E. BROOK, LTD., Empress Works, Huddersfield.—Catalogue No. 138, containing full particulars of single-, two-, and three-phase "Brook" motors.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—Three coloured cardboard cut-outs, advertising the company's loud speakers, telephones, and other radio apparatus; a showcard in colours dealing with "B.T.-H." valves; another dealing with "Mazda" lamps; and a wall card containing particulars of the lighting equipment of all automobiles sold in the United Kingdom.

MESSRS. G. & J. WEIR, LTD., Cathcart, Glasgow.—A brochure illustrating examples of the company's air compressors combined with steam and i.c. engines and electric motors.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Playhouse Yard, Golden, Lane, E.C.1.—A folder containing illustrations of advertisements for the use of retailers of "Lewcos" radio products.

Bankruptcy Proceedings.—F. E. KINZETT & SON (other than E. F. Kinzett, a minor), 54, Fielding Road, Chiswick, wireless factors.—The receiving order in this matter was made recently on a creditor's petition. The statement of affairs shows liabilities of £369, against assets of £152, leaving a deficiency of £217. Debtor Fanny Elizabeth Kinzett attributes the firm's position to bad debts, depression in trade, and law costs. It appears that she and her son, who is a minor, entered into partnership and traded as F. E. Kinzett and Son, without capital, as wireless factors. She borrowed £40 from her daughter, which is still owing, and as the business was unsuccessful, borrowed a further £70 from relations. In March, 1926, goods were obtained to the value of £189 from the petitioning creditor, which were sold to a firm from whom they state they were unable to recover the amount, and the business was discontinued on April 12th, 1926. Debtor admits that she became aware of her position in March last. The following are creditors:—

	£		£
Grace, J., Ltd.	300	Roberts, E.	20
Gracie, Mrs. M.	48	Horsfall, —	33
Pease, Mrs. A. C	40		

G. MASON and G. E. TINSLEY, trading as Mason and Tinsley, 6, Alberta Terrace, Sherwood Rise, Nottingham, electrical engineers.—The first meeting of creditors was held on September 30th at the Official Receiver's offices, Nottingham. The statement of affairs showed gross liabilities of £359, of which £336 was expected to rank, and there was a deficiency of £321. Debtors attributed their failure to trade profits being insufficient to meet their drawings from the business. It appeared that G. Mason commenced business without capital and under verbal arrangement only with another. This partnership was dissolved, and in September, 1924, he took Tinsley into partnership with him. The matter was left in the hands of the Official Receiver as trustee of the estate.

HERBERT MILNES, trading as H. Milnes & Son, 6, Trinity Street, Huddersfield, plumber and electrical engineer.—The first meeting of creditors was held on September 28th at the County Court House, Huddersfield. The statement of affairs showed gross liabilities of £2,655, of which £1,901 was expected to rank for dividend, against assets of £570. Debtor attributed his failure to lack of capital, ill-health, and losses on contracts. It was resolved to appoint Mr. A. Pontefract, accountant, as trustee of the estate.

F. A. HARTLEY and R. HARTLEY (F. A. Hartley & Son), electrical engineers, 98, Katherine Street, Ashton-under-Lyne.—Receiving order made September 24th on creditor's petition.

J. L. R. JENSEN (Jensen & McNicol), wireless accessories factor, 149a, Seabank Road, Wallasey.—First and final dividend of 1s. 3¾d. in the £, payable at the offices of the Official Receiver, 11, Dale Street, Liverpool.

L. A. WOODHEAD (trading as L. Woodhead), 25a, Charles Street, Bradford, wireless dealer.—Last day for receipt of proofs for dividend October 15th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

E. H. TANSEY, 65, Factory Road, Hinckley, Leicestershire, wireless dealer.—First and final dividend of 1s. 3¾d. in the £, payable at the Official Receiver's office, 1, Berridge Street, Leicester.

G. BOYD, New Road, Mousehill, Milford, Surrey, electrical engineer.—Receiving order made September 27th, on debtor's own petition.

JOSEPHINE A. HEREFORD-LAVEY and VIOLET DE FRECE (Radio Cash Stores), 371, Upper Street, Islington, N.1, and at Leeds and Nottingham, electricians.—Last day for receipt of proofs for dividend, October 17th. Trustee, Mr. C. Latham, 78, New Oxford Street, W.C.1.

VIOLET DE FRECE (separate estate).—Last day for receipt of proofs for dividend, October 17th. Trustee as above.

L. L. James, 62, Canterbury Street, Gillingham, Kent, and at Rochester, electrical engineer.—Application for discharge to be heard November 10th, at the Court House, Rochester.

H. Fildes, 108, Monton Road, Eccles, electrical engineer's superintendent.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released September 24th.

W. R. Squire, 11, Steward Street, Spring Hill, Birmingham (residing at Edgbaston), electrical engineer.—Last day for receipt of proofs for dividend, October 18th. Trustee, Mr. C. Holt, Official Receiver, 191, Corporation Street, Birmingham.

Company Liquidation.—Wates Bros., Ltd.—Winding up voluntarily. Liquidator, Mr. W. B. Anderson, 40-43, Norfolk Street, Strand, W.C.2, appointed September 24th. Meeting of creditors, October 14th, at the Institute of Chartered Accountants, Great Swan Alley, E.C.2. Claims to be sent to the liquidator by October 31st.

Dissolution of Partnership.—Sadleir & Savage, electricians, Madoc Street, Llandudno.—Messrs. E. W. Sadleir and T. Savage have dissolved partnership. Debts will be attended to by Mr. Sadleir.

Proposed Canadian Power Merger.—According to the Toronto correspondent of the *Financial Times*, it is expected that a huge power merger in Quebec will be announced shortly. At the head of the scheme are Sir Herbert Holt, president of the Royal Bank of Canada and a director of several electrical companies, and Mr. J. E. Aldred, president of the Shawinigan Power concern. The merger will embrace the Shawinigan Power, the Quebec Power, the Duke Price Power, the St. Maurice Power, the Laurentide Power, the Montreal Light, Heat and Power companies, and the undeveloped Carillon Power project at Ottawa. These companies have a combined capital of over a quarter of a billion dollars.

Break in German Aluminium Selling Arrangements.—The members of the Aluminium Rolling Mills Syndicate, to which 28 mills belonged, have decided to discontinue sales activity through the sales office at Cologne as a result of the withdrawal of one member. As from the present time the mills will undertake their own sales business independently without any obligations in regard to prices.

United States Electrical Exports.—The exports of electrical goods and apparatus from the United States during July last were valued at $7,942,000, an increase of $1,507,983, or 22 per cent., over the figure for July, 1925. *Commerce Reports* states that the largest increase occurred in the case of bare copper wire, which rose by $237,946 to $331,375, while shipments of insulated copper wire and cable increased by 9 per cent. Generators showed large gains—56 per cent. in the case of d.c. and 27 per cent. in a.c. machines. Complete steam turbo-generator sets also showed a substantial increase. Battery exports of all classes were 24 per cent. above those of July, 1925, and transforming and converting apparatus rose by 44 per cent. Other classes which recorded large rises were motors and control gear, domestic appliances, telegraph apparatus, and wiring supplies and fixtures. Generator accessories and parts declined by about 54 per cent., and electric locomotives by 45 per cent. Another large decrease occurred in the case of radio apparatus, which fell from $643,463 to $501,742, or nearly 22 per cent. The exports of fans, railway signalling equipment, ignition apparatus, and insulating materials were also considerably lower than in the corresponding month of last year.

Chinese Notes.—A long-distance telephone service is being installed between Foochow and Yenping by the Fukien authorities.

The districts surrounding Hsuchow, such as Fenghsien, Tangshan, Suining, and Peihsien, have installed an inter-district telephone service.

The Shanghai Mutual Telephone Co., Ltd., made a net profit of 202,058 taels during 1925, as compared with 199,649 taels in 1924. A dividend of 3½ taels per share was paid on 50,000 shares. The number of telephones in use increased by 912 to 22,975. The highest daily total of calls was 198,155.

The Dutch Electrical Market.—A United States commercial officer at The Hague reports that a larger market for modern electrical household appliances has recently been created in the Netherlands as a result of the activities of the municipal electric works at Amsterdam, and as American products are generally favoured by the Dutch public, the business possibilities for American manufacturers have improved. The general application of electrical appliances has been restricted by the comparatively high rates—from 20 to 35 Dutch cents per kWh. Consequently the number of electrical household appliances used has been small. Special rates are now being quoted for electricity used during the daytime, and the municipal electrical works at Amsterdam has announced that it will supply electrical energy (220 volts, 50 cycles) at a so-called "night tariff" of 2 Dutch cents per kWh from 11 p.m. to 7.30 a.m. The municipal enterprise is demonstrating devices in a special showroom. Among the articles shown is an electric stove which stores heat during the night hours for use the next day. When the stove, which weighs about 330 lb., is fully charged, the inside temperature is 275 deg. C., while the outside is 70 deg. C. Increased sales of electrical household appliances have resulted from the reduction in rates and the systematic advertising programme.

Unemployment in Germany.—According to the latest available returns, there were still 1,484,000 unemployed in Germany on September 15th. There were over 2,000,000 in February last.

Combustion Recorders Contract.—Messrs. James Gordon and Co., Ltd., have received an order from a prominent industrial company for 46 "Duplex Mono" combustion recorders. These instruments record both CO^2 and CO on one chart.

Local Exhibitions. — Thornton. — The District Council opened a six days' electrical exhibition, last week, to bring before the inhabitants the latest electrical fittings and appliances. It was opened by Councillor J. Marshall, chairman of the Electricity Committee. Representatives of various firms gave demonstrations. Councillor Marshall mentioned that there were already 400 householders using electricity and another 250 had applied for a supply. The exhibition was under the superintendence of Mr. A. G. Cooper, electrical engineer.

Harwich.—The borough electrical engineer (Mr. E. Jordan) is organising an electrical exhibition to be held at the Drill Hall, Dovercourt, from October 19th to 23rd inclusive.

Tunbridge Wells.—On Wednesday last the Mayor (Ald. C. E. Westbrook) opened an exhibition of electrical cooking, heating and domestic appliances at the Pump Room. The exhibition, which remains open until October 16th, has been organised by the Electricity Department (engineer: Mr. R. N. Torpy).

Chinese Electrical Imports.—The *Journal* of the British Chamber of Commerce in Shanghai recently reproduced official statistics of China's foreign trade during 1925. These show that machinery for electric power stations to the value of 858,151 Haikwan taels (tael = 3s. 8d. approx.), was imported during the year, as compared with 807,581 taels in 1924. The British share is not stated, but Great Britain was the largest supplier of machinery as a whole, being followed by the United States. The imports of electrical materials and accessories declined in value from 8.2 million taels in 1924 to 6.9 million taels in 1925. The proportion supplied by Japan increased from 2,170,844 taels to 2,366,913 taels, but all other countries' shares decreased—Germany's from 2,170,973 to 1,393,409 taels, Great Britain's from 1,236,112 to 1,198,922 taels, and the United States' from 1,215,343 to 851,387 taels. It is stated that the conduit was supplied principally by British manufacturers, who also supplied the higher grades of cables. The market for cheap cable was shared by Japan and Germany, and, the latter also provided most of the sundries, such as meters, switches, bells, &c. Most of the trade in fittings, heating appliances, dry cells and flashlights remained in American hands.

The E.C.A. and the "Electrical Ballot."—We learn that local branches of the Electrical Contractors' Association in all parts of the country have appointed strong committees to promote all possible local interest in the "W.O.B." campaign. The E.C.A. Bournemouth branch will open a model "Electric Home" or lease a central hall and install a series of model rooms. The Potteries branch has taken space under the E.D.A.-E.L.M.A. national advertisements and is publishing the names and addresses of seventeen local E.C.A. firms, from whom the "Competition Book" may be obtained. Similar action is being taken by the Newcastle branch and the movement is on foot in other areas. Messrs. Barnett & Soans (E.C.A.), of Burton-on-Trent and elsewhere, have overprinted the back of the "Competition Book" with a big display, giving the addresses of their several branches. Messrs. Robson and Coleman (E.C.A.), Newcastle, are sending out a large mailing card to *country* customers, inviting postal application for the "Competition Book."

United States Duty on Loud-Speakers.—Under a recent decision of the United States Customs authorities, loud-speakers and parts are subject to a 30 per cent. *ad valorem* duty, in common with other radio apparatus, upon importation into the country.

The Spanish Ban on Steel Imports.—The Sheffield correspondent of *The Times* states that a vigorous campaign is being conducted by Sheffield manufacturers, through the medium of the Sheffield Chamber of Commerce, for the repeal, or at all events some modification, of the Spanish decree which affects importation of steel. It has been stated that the ban, which practically eliminates foreign competition, seriously jeopardises a market in fine carbon steels worth something like £200,000 a year in contracts, involving a yearly loss in wages of £40,000, and the loss of an annual output of 2,000 tons of material. The decree has been described in Sheffield as practically prohibiting steel imports except for actual users. Sheffield's principal exporting houses have maintained big selling organisations to study Spanish needs. This has entailed an outlay of hundreds of thousands of pounds, and the organisation must be scrapped if the decree holds good. Reprisals are contemplated in the nature of counter-measures against the Spanish fruit trade.

New French Companies.—Among the new companies recently organised in France are the Société Hydro-Electrique de Cazeres (50, Avenue de la Bourdonnais, Paris), with a capital of 100,000 francs, to establish a hydro-electric station at Cazeres in the Department of Haute Garonne; the Société Secteur Electrique de Dorge-Le Haye-Descarts, to undertake the supply of electric power in the Departments of Indre-et-Loire and Vienne; and La Société de Transmission d'Energie pour l'Industrie (28, Rue de Courcelles, Paris), capital 1,000,000 fr., to erect and operate a transmission line between the power station of the Compagnie Vaudoise des Forces Motrices des Lacs de Joux et d'Orb and the various industrial works in the Bellegarde district.

Book Notices.—"Safety Rules for Radio Installations." Pp. 24. Washington, D.C., U.S.A. Government Printing Office. Price 10 cents.—This handbook of the Bureau of Standards, No. 9, issued by the U.S. Department of Commerce, comprises Part 5 of the fourth edition of the National Electrical Safety Code and has been formulated and approved according to the procedure of the American Engineering Standards Committee. The rules apply to both transmitting and receiving stations, including antennæ, counterpoise wires, lead-in conductors, earthing wires and connections, protective devices, and batteries; they do not, however, cover antennæ used for coupling carrier-current equipment to line conductors, neither are there any requirements for indoor aerials. The booklet should be found useful as a guide, though reference back to the main N.E.S. Code is frequent.

"The Electrical Contractors' Year-Book, 1926-27." Pp. 402. London: The Electrical Contractors' Association (Inc.). Price 5s.—In general, this new Year-Book follows the lines of its predecessors, the information, of course, having been brought up to date. A new feature is a very brief outline of the proceedings at the first E.C.A. Conference held at Brighton last June. The president's address is reproduced *in extenso*, in addition to the annual report. The frontispiece is a portrait of the new president, Mr. H. J. Miles, M.I.E.E.

"Magnetochimica," by O. Bonazzi. Pp. 123. Pisa: Tipografia Editrice Cav. F. Mariotti. Price 10 lire.

"Science Abstracts" (A and B). Vol. XXIX. Part 9. September 25th, 1926. London: E. & F. N. Spon. Price 3s. each.

"*Journal* of the South African Institution of Engineers." Vol. XXV. No. 2. September, 1926. Johannesburg: The Institution. Price 2s.

"Accumulator Charging, Maintenance, and Repair," by W. S. Ibbetson. Pp. x+118; figs. 33. Price 3s. 6d. net.

"Engineering Factory Supplies," by W. J. Hiscox. Pp. viii+176; figs. 49. Price 5s. net. London: Sir Isaac Pitman and Sons, Ltd.

"Die Ebene Vektorrechnung," by Dr. Ing. H. Kafka. Pp. viii+132; figs. 62. Price R.mk. 7.60; "Die Elektrischen maschinen," by Dr. Ing. M. Liwschitz. Pp. viii+337; figs. 284. Price R.mk. 14. Leipzig: B. G. Teubner.

Lighting and Power Notes.

Alton (Hants.).—Electricity Supply.—The Urban District Council has received plans of the proposed generating station to be erected by the Alton and District Electricity Co., Ltd. The plant will include two 170-h.p. oil engines, each coupled direct to a tandem set of a.c. and d.c. generators. Each a.c. set will have a capacity of 100 kW at 3,000/3,300 V, 50 cycles, and the d.c. sets will be of 70 kW at 110/115 V. It is anticipated that the station will be in operation within six months of the date on which sanction is received to the company's application for consent to the scheme. The proposed charge for lighting is 10d. per kWh.

Australia.—Canberra.—According to the *Industrial Australian and Mining Standard*, the New South Wales Minister for Works and Railways recently stated that the Federal Government was negotiating with the State Government for the supply by the latter of electricity for the Federal Capital city. The proposal was that the State Government should supply Canberra from Burrinjuck for a period of 10 years, and he hoped that not only would the arrangement be made, but that it would be continued indefinitely.

Barnsley.—Electricity in Small Houses.—The Town Council has adopted a hired wiring system for cottage property, and has applied for sanction to a loan of £5,000 to cover the cost of wiring the first houses under the scheme.

Barrow.—Engineer Censured.—The *Manchester Guardian* reports that at a meeting of the Town Council on October 4th, a vote of censure was passed upon the electrical engineer who, it was stated, had spent £6,900 on the laying of a cable in connection with the Backbarrow scheme, without the consent of his committee. The scheme had since been rejected by the Electricity Commissioners. An amendment that the engineer be asked to resign was defeated.

Bexhill.—Loan Sanctioned.—The Electricity Committee has obtained sanction to a loan of £14,000 for mains, services, and meters.

New Main.—The Committee has decided to lay a larger main at a cost of £1,000 to improve the supply in the Barnham Lane area.

Canada.—Electrical Development.—The Canada Electric Co., Ltd., is erecting a new station near Meccan, N.S., to produce electricity from coal at the pit mouth. The new plant is of special interest in that it is designed to use the slack coal and screenings, in pulverised form, from adjacent collieries. It will supply electricity to the towns of Amherst and Springhill and to collieries.

Cardiff.—Year's Working.—We have received from Mr. C. G. Morley New, city electrical engineer, a copy of his report, together with the statement of accounts, on the working of the Corporation electricity undertaking for the year ended March 31st last. The total revenue amounted to £242,721, as compared with £224,702 in 1924-25. Working expenses increased from £109,070 to £117,870, leaving a gross profit of £124,851, as against £115,632, to which was added income from other sources, making a total of £130,422 available. Capital charges absorbed £80,246, and there was a net profit of £50,176, as compared with £51,899 in the preceding year. A contribution of £33,366 was made to the borough fund. The capital expenditure during the year amounted to £110,602, and included £50,190 for machinery and £48,399 for mains and services. The sales of electrical energy increased from 25,671,031 to 32,500,954 kWh, and the maximum supply demanded from 12,940 to 15,636 kW. The average price obtained per kWh fell from 2.10d. to 1.79d., being the lowest since the inception of the undertaking. The plant was extended during the year by one 5,000-kW turbo-alternator, one boiler, and a complete ash-handling plant and bunker.

Clayton (Yorks.).—Electricity Supply.—With regard to the question of electricity supply to Clayton, in respect of which Bradford Corporation recently agreed to withdraw its application for an Order if the Yorkshire Electric Power Co. would also withdraw its scheme, the company has now written the Clayton Council, pointing out that the withdrawal of the applications by the two outside bodies would settle only the lighting question, leaving the question of power supply still open. The company suggests that, pending the Council's arrangements for bulk supply, it should insert in the proposed Clayton Order a clause that the consent of Clayton shall not be required by the company to supply electricity within the Clayton urban area for all or any of the purposes for which the company could have supplied electricity if the Clayton Order had not come into force. If the Council is prepared to insert such a clause, the company will withdraw its objection, and thus avoid an inquiry.

Colwyn Bay.—Price Reduction.—The Urban District Council has reduced the charge for electricity for lighting from 6d. to 5d. per kWh.

Continental.—France.—La Compagnie Electrique du Nord has recently completed the installation of 45,000-V transmission lines between Valescourt and Montdidier and between Laon and Soissons, bringing the total length of its 45,000-V system to about 340 miles. A line for a similar pressure is also in course of erection between Chaulnes and Roye.

Belgium.—Considerable development is taking place in the distribution of electricity to the small towns and villages in the province of Antwerp. The provincial authorities are to purchase the electricity in bulk from the power station of the Société d'Electricité de l'Escaut, and supply it to the various communes. The energy is to be transmitted from the central station at Merxem at 50,000 V to a transformer station at Beersse, when it is to be stepped down to 15,000 V. Each commune is responsible for the transformer stations to reduce the current to 220 V for l.p. distribution. In order to ensure a constant supply, the provincial authorities have placed a second contract with the Société d'Electricité de la Campine for a supply from its station. The transmission lines are being so arranged that should a breakdown occur at either of the two power stations, the whole load can be switched over on to the other.

Coventry.—Loan.—The Electricity Committee has recommended the City Council to apply for sanction to a loan of £3,459 for a h.p. main.

Croydon.—Loans Sanctioned.—The Electricity Committee has received sanction to the following loans:—£6,899 for street lighting; £4,380 for mains; and £40,505 for plant.

Earls Barton.—Inquiry Decision.—As the result of an inquiry held in June last, the Electricity Commissioners have informed the Wellingborough Rural District Council that the Ministry of Transport has consented to the use of overhead lines at Earls Barton for the supply of electricity by the Northampton Electric Light and Power Co., Ltd. The Council had opposed the use of overhead mains.

East Ham.—Loans Sanctioned.—The Electricity Committee has obtained sanction to loans of £500 for cooling plant and £10,000 for the extension of distribution cables.

Glasgow.—Electricity in Small Houses.—After hearing reports by the Director of Housing and the electrical engineer with regard to the question of introducing electricity for lighting, heating, and other purposes in rehousing schemes, the Corporation Housing Sub-Committee has agreed to recommend that an "all-electric" experiment should be carried out at the Duke Street and Govanhill schemes. At Duke Street the houses number 180 and at Govanhill 248. If the proposal is approved by the Corporation it is the intention of the Housing Department to install penny-in-the-slot meters, and the charge will be a flat rate of 1d. per kWh.

Gravesend.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. C. F. McInnes) for the year ended March 31st last show a net surplus of £14,630, as compared with £8,857 in the preceding year. The favourable domestic rate introduced a short time ago is proving very successful.

Greenock.—Loan Sanctioned.—The Corporation has received sanction to a loan of £36,640 for the following purposes:—Plant and accumulators, £14,240; main transmission line, £2,400; mains and services, £20,000.

Irish Free State.—Dublin.—Further development of the municipal electricity undertaking is foreshadowed in a report which is to be submitted to the City Commissioners at their next meeting. Sanction is sought to an application to the Ministry for Industry and Commerce for a loan of approximately £500,000 to carry out extensions of the existing system and to make provision in connection with the Shannon scheme in so far as it will affect Dublin. The latter expenditure, which is earmarked for the provision of cables to bring the electricity from Dolphin's Barn, or Kilmainham, to the central station, will be necessary only when arrangements are made for the supply of electricity in bulk to the Dublin Electricity Department from the Shannon scheme.

Gloucestershire.—Inquiry Decision.—At a recent meeting of the County Council it was reported that as a result of a recent inquiry, the Electricity Commissioners had decided to sanction the application of Cheltenham Corporation to extend its area of electricity supply so as to include certain parishes in the rural districts of Winchcombe and Cheltenham. The application of the Gloucester Corporation in respect of the rural district of Gloucester was also granted. The Commissioners had, however, refused the application of the West Gloucestershire Power Co., Ltd., in so far as it related to the rural districts of Cheltenham, Gloucester and Newent, and were to proceed with consideration of the application on the basis of the reduced area of supply, namely, the urban district of Usk, the rural district of Monmouth, and parts of the rural districts of Chepstow, Lydney, and Pontypool.

Harwich.—Loan.—The Corporation Electricity Committee is to apply for sanction to a loan of £5,000 for the following purposes:—Meters £1,000, services £2,000, assisting wiring scheme £1,500; apparatus to be let out on hire, £500. Mr. E. Jordan, the borough electrical engineer, informs us that over 200 applications have been made under the assisted wiring scheme, and the total number of consumers has increased to 900 since the commencement of the supply in January, 1925.

Lancaster.—Loans.—The Corporation is applying for sanction to the borrowing of £2,400 for mains and cables for Scotforth Housing Estate, and £2,100 for additional h.p. switchgear at the Caton Road, Marton Street, and Bowerham stations. A new sub-station is to be erected on St. George's Quay.

Lichfield.—Inauguration of Supply.—An interesting connecting link between Walsall and Lichfield was cemented on Thursday evening last week, when a supply of electricity was switched on from the transformer station in Lichfield. Under this scheme electricity is being supplied by Walsall in bulk at the boundary of Walsall's extended area on the Lichfield side of the Aldridge Colliery; and from that point the transmission cable to Lichfield is the property of the Lichfield Corporation. The supply is delivered at a pressure of 11,000 V, and reduced to a suitable pressure for distribution.

London.—St. Marylebone.—The Finance Committee has reported to the Borough Council that sanction has been received to a loan of £13,184 for transformer stations in the Oxford Circus district.

Battersea.—The Electricity Committee has obtained sanctioned to the borrowing of £27,500 for alterations and additions to the condensing system at the power station, and £9,500 for the extension of the Nine Elms sub-station.

The Council has voted £1,000 for mains extensions and £1,080 for wiring premises.

Morecambe.—Supply for Pumping Station.—On application from the Heysham Urban District Council, the Corporation Electricity Committee has agreed to supply electricity for a proposed sewage pumping station at Lower Heysham and is applying for sanction to borrow £6,000 for the scheme.

Loans Sanctioned.—Sanction has been received to the borrowing of sums totalling £39,655 for mains and plant.

Plymouth.—Loan Sanctioned.—The Corporation has received sanction to the borrowing of £18,183 for the purchase of new plant. This sanction relates to part of a scheme for modernising the electricity undertaking at a cost of £169,000. The Electricity Committee has authorised a number of cable extensions.

Prestatyn.—Electricity Agreement.—The Urban District Council has sealed an agreement with the North Wales Power Co., Ltd., for a supply of electricity to the district. The agreement provides that a supply shall be available from March 14th, 1927, and shall be operative for a period of 14 years. A sub-committee has been appointed to consider the question of distribution, and the engineer has been instructed to prepare specifications for the erection of a sub-station to house two transformers.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

Cheadle and Gatley.—Domestic lighting: From 6d. to 8d. per kWh.

Glasgow.—An increase of 10 per cent.

Sheffield.—All energy charged at 2d. per kWh or under, increased from 10 per cent. to 30 per cent. on the basic rate. All energy over 2d. per kWh from 5 to 15 per cent. on the basic rate.

Bury.—Lighting: An increase of 10 per cent. Power: An increase of 15 per cent.

Elland.—An increase of 5 per cent.

Barnstaple.—An increase of 10 per cent.

East Ham.—An increase of 10 per cent.

Winchester.—An increase of 7½ per cent.

Northampton.—*The Northampton Electric Light and Power Co., Ltd.*—An increase of 10 per cent.

Pwllheli.—Electricity Agreement.—The Corporation has entered into an agreement with the North Wales Power Co., Ltd., for a supply of electricity to the town. Contracts for the laying of cables have been placed.

Shipley (Yorks.).—Electricity in Bulk.—At a recent meeting of the Urban District Council, the chairman of the Electricity Committee reported that negotiations had been opened with the Yorkshire Electric Power Co. with a view to securing a bulk supply of electricity for the whole district. In answer to a question as to whether the existing generating plant would be scrapped, he stated that the Council would not be allowed to extend the local plant and as it was insufficient for the town's growing needs the Council had agreed for half the town's requirements to be supplied by the company. This method was expensive and the Committee now proposed to purchase the whole supply, which would result in a saving of £2,000 per year and would involve the scrapping of the existing generating plant.

Southend-on-Sea.—Electricity Supply.—The Corporation Electricity Committee has had under consideration the following three schemes for the future development of the electricity supply undertaking:—(1) An offer from the County of London Electric Supply Co., Ltd., to provide a bulk supply from its power station at Barking; (2) A scheme submitted by Mr. R. Birkett, borough electrical engineer, for the erection of a steam power station at Canvey, to operate in conjunction with Diesel plant at the present stations. The new station would include two turbo-alternators, one of 4,000 kW, and one of 6,000 kW, and the estimated cost would be £258,300. Additional Diesel plant with a capacity of 1,250 kW would be added to the existing stations at an estimated cost of £26,422, the total cost of the whole scheme, including £70,224 for transmission lines, and £90,090 for converter plant, being £445,036. (3) A scheme proposed by Mr. J. H. Ryder, consulting engineer to the Council, for the erection of a new power station at South Fambridge, at an estimated cost of £649,000. The Committee has recommended the Town Council to accept Mr. Ryder's scheme, and the Council is to discuss the whole question at a special meeting to be held shortly.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Blackpool Corporation to supply electricity in the urban district of Poulton-le-Fylde and the townships of Carleton and Marton; Tilbury Urban District Council to supply in the urban district; and the Chesham Electric Light and Power Co., Ltd., in parts of the rural districts of Amersham, Hempstead, and Watford.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Crewe Town Council to supply electricity within parts of the rural district of Nantwich; the Cark & District Electricity Co., Ltd., to supply in certain parishes in the rural district of Ulverston; and the Slough & Datchet Electric Supply Co., Ltd., in certain parishes in the rural district of Eton.

Tynemouth.—Supply for Docks.—The Tyne Improvement Commission is negotiating for a further supply of electricity to the Albert Edward Dock and district.

United States.—Electrical Development.—According to *Power*, an order for a steam turbo-generator of 104,000 kW has been placed with the Westinghouse Electric and Manufacturing Co. by the Commonwealth Edison Co., of Chicago. To be installed at the Crawford Avenue station, the new unit will make a total of six turbo-generators aggregating about 450,000 kW.

The Brooklyn Edison Co. put into operation on September 1st the largest steam-driven generating unit ever built. This set, costing over $1,000,000, is the fourth machine to be installed in the company's $50,000,000 power plant at the foot of Hudson Avenue, Brooklyn, N.Y. Built by the Westinghouse Electric and Manufacturing Co., it has a capacity of 80,000 kW. The over-all length is 64 ft. 6 in., and the entire unit weighs more than 2,000,000 lb. In addition to the turbo-generator, this equipment also includes an 80,000-sq. ft. Westinghouse surface condenser. This is also the largest of its kind ever built.

Uxbridge.—New Electricity Charges.—With a view to inducing consumers to use electricity for domestic purposes, in addition to lighting, the Uxbridge and District Electricity Supply Co., Ltd., has introduced the following rates for domestic supply:—(1) A flat rate of 8d. per kWh for all purposes, through one meter; or, alternatively (2) an assessment tariff of 4s. in the £ per annum, payable quarterly, on the net rateable value of the premises in Buckinghamshire, and 4s. 6d. in the £ per annum, payable quarterly, on the net rateable value of the premises in Middlesex, plus 1½d. per kWh for electricity consumed for all purposes through one meter.

Wimbledon.—Loans Sanctioned.—The Electricity Committee has received sanction to loans of £10,000 for the purchase of domestic appliances and £5,000 for wiring of premises.

Wolverhampton.—Transfer of Undertaking.—The Corporation Electricity Committee has recommended the sealing of agreements in connection with the transfer of generating station to the West Midlands Joint Electricity Authority.

York.—Loans Sanctioned.—The Town Council has received sanction to a loan of £3,777 for mains and services in respect of expenditure previous to March 31st last, and to a further sum of £16,000 for mains and services for a future period.

Tramway and Railway Notes.

Australia.—Sydney.—The new tube railway in Sydney, the first to be constructed in Australia, was inaugurated on October 3rd.

Blackpool.—Year's Working.—The report of the manager of the Corporation tramway undertaking (Mr. C. Furness) for the year ended March 31st last shows a revenue of £297,942, as compared with £272,420 in the preceding year. Working expenses amounted to £197,146, as against £196,162, leaving a gross profit of £100,796 (£76,258). A deficiency of £2,282 on the motor-omnibus service was deducted from the surplus, and to it was added revenue from other sources of £3,404, making a total of £101,918 available. After meeting capital charges there was a net profit of £64,499, as compared with £41,820 in 1924-25. A contribution of £17,000 was made to the borough fund. The amount spent on capital account was £70,447, the chief items being £18,234 for reconstruction of permanent way, £11,674 for new cars, and £14,080 for tramway extensions. The car-mileage increased from 2,691,698 to 2,935,852, and passengers carried from 40,943,713 to 44,731,094.

Brighton.—Proposed Railless Cars.—In connection with a proposal for the extension of the tramway on the Lewes Road route, at a cost of £25,000, the General Purposes Committee has suggested postponement so that the Tramways Committee may submit a scheme for a system of railless cars.

Continental.—Switzerland.—An avalanche from the Glacier de Plan-Névé occurred on September 27th. It descended into the Rhone Valley and carried away a bridge on the Simplon railway. An electric train due from Brigue escaped destruction, but was embedded in the *débris*. A considerable portion of the line was cut off, and traffic was diverted by way of the Lötschberg tunnel The new bridge over the St. Barthelemy torrent was completed on October 1st, and traffic on the Simplon line has been resumed.

Leicester.—New Route.—The Corporation Tramways Committee is to proceed with the construction of tramways in Coleman Road, at an estimated cost of £12,500.

Liverpool.—New Cars.—Fifty tramcars of a new type, designed by Mr. P. Priestly, general manager of the Corporation tramways, have been put into service. The new cars have a 11 ft. 6 in. wheel base, with sliding axles, which will allow the wheels to accommodate themselves to the curve, and transverse seating is employed. The new cars will seat 48 passengers on the upper deck and 34 on the lower. The electric lamps are frosted round the base to obviate glare.

Manchester.—Omnibus Services.—The Corporation Tramways Committee has under consideration a proposal to supplement the main tramway system by an express 'bus service.

Stoke-on-Trent.—Proposed Transfer of Undertaking.—The Town Council has considered a proposal to take over on lease the undertaking of the Potteries Electric Traction Co., Ltd., and has instructed the Town Clerk to obtain particulars as to income and running costs. The matter will be further considered on receipt of this information.

Wolverhampton.—Year's Working.—The report on the working of the Corporation tramway undertaking (general manager: Mr. C. O. Silvers) for the year ended March 31st last records a total revenue of £91,986, as compared with £95,027 in the preceding year. Working expenses amounted to £60,722, as against £60,539, leaving a gross profit of £31,264 (£34,488), to which was added income from other sources, making a total of £34,442. After meeting capital charges, there was a net profit of £11,744, as compared with £14,837 in 1924-25. The number of passengers carried increased from 14,494,020 to 15,244,982, but the car mileage decreased from 1,070,514 to 1,067,408.

The railless-car system showed a total income of £36,823, and working expenditure of £25,749, leaving a gross profit of £11,074. The figures for the preceding year were:—Income, £17,744; working expenses, £11,618; gross profit, £6,126. Capital charges absorbed £6,169, and there was a net profit of £4,905, as compared with £3,196 in the previous year. The number of passengers carried increased from 2,541,808 to 4,673,739, and the car-miles run from 252,767 to 561,439.

There was also a net profit from the motor-omnibus system of £7,090, making a total surplus on the three systems of £23,769.

The Dudley-Wolverhampton tramway route was taken over from the local tramway company during the year, and a portion of the route converted to railless traction.

Purchase of Tramway.—The Transport Committee has recommended to the Town Council the purchase of the tramway belonging to the Wolverhampton District Electric Tramways, Ltd., between Market Place, Willenhall, and the borough boundary, at a cost not exceeding £6,500.

Telegraph and Telephone Notes.

Canary Islands.—New Radio Stations.—The Spanish Government is to establish radio stations in the Canary Islands, according to *Commerce Reports*, which says that contracts for their installation are being arranged with the Compania Telefonica Nacional de Espana.

France.—Ships' Radio Installations.—Interesting figures have lately been issued by the Compagnie Maritime, of Paris, which controls the installation of wireless apparatus on French steamers, which show the rapid progress made in recent years. Thus, whereas only 200 French steamers and 50 motor fishing and other vessels were fitted with wireless telegraph gear in 1915, the number of installations carried out by the company had by the end of 1925 increased to 900 and 240 respectively.

Irish Free State.—Telephone Service.—In the scheme initiated by the Free State Minister of Posts and Telegraphs for the extension of the telephone service, the progress made has been of a satisfactory character, and the scheme will, if availed of, avoid the use of circuitous routes for trunk calls, and obviate unnecessary delay. It is gathered that there will be no initial payment for the installation of a telephone; a nominal rent, to be paid quarterly, will be imposed, in addition to a charge for calls in accordance with the standard scale.

Poland.—Long-distance Telephony.—Negotiations are in progress for the establishment of through telephone connection between Warsaw and Moscow, and an understanding has been reached by the Governments of Poland and Russia, says *Commerce Reports*. A through line already exists from Warsaw to Stolpce, and could be used immediately by installing a series of amplifiers. In Russia, however, it will be necessary to undertake the construction of a new line from Stolpce to Smolensk, which will require several months. The cost of this construction is estimated at $257,000.

Russia.—Automatic Telephony.—The Swedish L. M. Ericsson Company is reported to have received from the Russian Low-Tension Trust an order for an automatic telephone exchange for the town of Rostoff, of a capacity representing 10,000 lines. At present 18 telephone exchanges operated according to the Company's automatic system are in course of construction for a total of 95,500 lines, including stations in Norway, Holland, Italy, and South Africa.

Sweden.—Telegraph and Telephone Services.—The gross receipts of the Telegraph Administration for 1925 amounted to 81,685,168 crowns, representing an increase of 1,575,043 crowns over the gross receipts of 1924. Telephone receipts constituted 85 per cent., telegraph 10 per cent., rent 3 per cent., and wireless about 2 per cent. of the total gross earnings. The number of telephone stations increased from 3,566 to 3,604 and subscribers to the Government telephone system increased from 338,187 in 1924 to 352,722 in 1925. In January, 1926, there were about 434,600 telephones in use, or approximately 73 telephones per 1,000 inhabitants.

The Telephone Service.—North-Western Telephone Centre.—The telephone administration headquarters for the North-Western District, embracing Lancashire (Liverpool and Manchester excepted), Cumberland, and Westmoreland, has been transferred from Blackburn to Preston, where clerical and accounting work will be centralised. The change involves the transference of a large staff.

New London Exchanges.—Two new telephone exchanges, named "Rodney" and "Reliance," were opened in Liverpool Street, S.E.17, on October 1st to give relief to the "Hop" exchange and to provide for development in the Walworth and Oval areas. The new exchanges, which are accommodated in one building, are fitted with central-battery equipment, and have a capacity of a total of 3,700 lines. At the time of opening approximately 1,257 lines will be transferred to the "Rodney" exchange and 779 lines to the "Reliance" exchange.

Edinburgh Automatic Exchange.—Automatic equipment, installed by Messrs. Siemens Bros., was brought into use on October 3rd; at present 13,740 lines have been transferred, but the plant has a capacity of 23,560 lines. This is the first transfer in what is to be a multi-exchange automatic area.

News by Telephone.—Figures issued by the Post Office indicate the exceptional use made of the telephone to obtain news during the general strike in May. The number of inland trunk traffic calls made during the month amounted to 8,641,893, an increase of 1,438,181, or 20 per cent. over the number in the corresponding month last year. The total number of telephones working on the system at the end of July (the latest month for which figures are available) was 1,426,042; of these, London claimed 500,893 and the rest of Great Britain, including Northern Ireland, 925,149. During the quarter to the end of June 55,621 new telephone stations were added to the system; there were 26,594 cessations, a net addition of 29,027 stations.

Italy.—Radio-telegraphy.—A regular radio-telegraph service between Italy and Austria was inaugurated on October 4th.

Trinidad.—Proposed Radio Stations' Sale.—The Finance Committee of the Legislative Council of Trinidad recommends the sale of the wireless stations belonging to the Government to the Pacific Cable Board, but advises that the price be raised to £7,000, says *The Times*, failing which that a minimum royalty of £1,000 per annum be paid by the Board for five years.

Switzerland.—Telegraph and Telephone Services.—A report lately issued shows that the length of the telegraph and telephone wires in use in Switzerland at the end of last year amounted to 567,365 miles, of which 434,375 miles are underground. The number of telegrams dealt with last year, excluding transit messages, amounted to 5,100,000; the use of telegraphy is, however, declining, while there is a growing use of the telephone, the number of instruments in use increasing last year from 189,429 to 200,211.

Radio Notes.

Algeria.—New Station.—The French Colonial Post and Telegraph Administration has established a broadcasting station in Algiers. The plant operates on 310 metres and 100 watts, and, in addition to a local programme, will relay the Eiffel Tower transmission.

Holland.—Prospective New Station.—As a possible solution of the present difficulties with regard to political and religious differences, the Katholieke Radio Omroep and the Nederlandsche Christelijke Radio-vereeniging have made a joint application for a licence to acquire, or erect, a new transmitting station, says *World Radio*. The application has been granted for a preliminary term of one year, and the new station will have the call letters PX9; it will probably be situated at The Hague.

Japan.—Broadcast Companies' Fusion.—The Commercial Secretary at Tokyo informs the Department of Overseas Trade that the three independent broadcasting associations hitherto existing at Tokyo, Osaka, and Nagoya have been merged in the Shadan Hojin Nihon Hoso Kyokai (Incorporated Japan Broadcasting Association) as from August 20th. The three stations already in use will henceforth be operated by the Incorporated Association, under the title of the Tokyo, Osaka, and Nagoya Central Broadcasting Bureaux respectively. The arrangements established with subscribers are being continued by the new Association, and for the present the broadcasting services are being conducted as before. The amalgamation was organised by the Ministry of Communications with a view to the exercise of closer supervision.

United States.—Radio Legislation.—Senator Dill, of Washington State, when asked about the National Broadcasting Co. announced by the Radio Corporation of America, said, according to the *Electrical World*: "I welcome such an undertaking, because . . . if it is properly directed . . . the public in general will benefit by better radio service . . . provision is made in both the Dill Bill, which has passed the Senate, and the White Bill, which has passed the House, that wave-length licences can be revoked should there be any earmarks of monopoly." Senator Dill expects radio legislation to be passed before Christmas. He points out that, despite the decision by the Department of Justice that Secretary Hoover has no authority under existing laws to regulate wave-length, power output, and "time on the air," the self-control of the broadcasting stations, stimulated by the nature of the radio business, compels stations to remain on the wave-lengths assigned by the Department of Commerce.

Radio Fair.—The "Radio World's Fair" opened at New York on September 13th and closed on September 18th. Three hundred manufacturers displayed their wares. The general tendency in design was toward the batteryless set, and in cabinets the trend was toward the console pattern. More than 140,000 people had visited the show by September 17th, according to semi-official estimates. An English boy, William Tricker, of Andover, won the first prize in a competition for the best one- or two-valve sets made by amateurs; four other English boys won prizes for skill in building receivers.—*Reuter's Trade Service* (New York).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Ashford.—Electricity Committee. 30-kW motor generator. (See this issue.)

Australia.—Melbourne.—October 20th. Victorian Government Railways. Rail motor equipment. (A.X. 3449.)*

October 26th. Postmaster-General's Department. Telephone plugs and sleeves. (B.X. 2799.)*

November 3rd. Pole transformers. (B.X. 2914.)* Pole-changing transformers. (B.X. 2915.)*

November 9th. Telephone transformers. (B.X. 2797.)* Telephone protective apparatus. (B.X. 2840.)*

November 26th. Primary battery material. (B.X. 2900.)*

Sydney.—October 18th. Municipal Council. Two 100-ton electrical overhead travelling cranes. (A.X. 3467.)*

November 1st. Boiler feed pumps for Bunnerong power station. (A.X. 3470.)*

November 15th. 33,000-V cable and pilot cable. (Spec. 1,047.) (B.X. 2882.)*

November 29th. Circulating water screens. (Specification 1,014.) Specifications from Constructional Engineer, Electricity Department, Town Hall, Sydney.

Barnes.—October 12th. Electricity Department. One 40,000-lb. water-tube boiler, coal- and ash-handling plant, steel-plate chimney, bunkers, &c. (September 24th.)

Barry.—October 25th. Gas, Water, and Electricity Department. Underground mains, sub-station transformers, and meters. (September 24th.)

Carlisle. — October 18th. Electricity Department. Lagging of the complete steampipe system at the new generating station. (October 1st.)

Dublin.—October 18th. Electricity Supply Department. Four water-tube boilers, stokers, economisers, feed pumps and accessories, necessary buildings, foundations, &c. (September 10th.)

5,000-kW generating set complete. (September 17th.)

Dundee.—October 22nd. Electricity Department. 4-core, 3-core, and 2-core l.p. lead-covered cable. (See this issue.)

Durham.—October 16th. Durham County Council. Electrical work required in conversion of Earl's House School and other buildings into tuberculosis hospital. Particulars from Messrs. W. & T. R. Milburn, architects, 19, Fawcett Street, Sunderland.

Eastbourne.—November 5th. Electricity Department. One water-tube boiler, economiser, feed heaters, two steel chimneys with induced-draught plant, interconnecting pipework, &c. (See this issue.)

Edinburgh.—October 18th. Electricity Supply Department. Two motor-driven circulating water pumps, drainage pump, valves and pipework. (September 17th.)

Egypt.—Cairo.—January 1st. Director-General, Mechanical Department, P.W.M. Supply and erection at the site of the Seru pumping and power station of four internal-combustion Diesel alternator groups, three pumps and accessories. Chief Inspecting Engineer in London, Queen Anne's Chambers, Broadway, Westminster, S.W.1. Supply of telegraph and telephone materials, at a cost of between £E.26,000 and £.E28,000.

November 1st. Director-General of Municipalities and Local Commissions, Savoy House, Cairo. Supply of about 30,000 electric lamps to the various municipalities and local commissions.

Ilford.—October 26th. Electricity Department. Transformer kiosk, transformer and switchgear, switch kiosk and switchgear, l.p. paper-insulated cables. (See this issue.)

India.—October 16th. India Store Department. Four electrically-driven horizontal centrifugal or turbine pumping sets, with transformers. (A.X. 3590.)*

October 20th. Sub-station plant for Ridge Institute, Jubbulpore, including transformers, condensers, cables, ironclad switchgear, &c. (October 1st.)

London.—London County Council.—October 11th. Electrical installation at the County Secondary School, Sutherland Grove, Wandsworth, S.W. (October 1st.)

Manchester.—October 12th. Tramways Committee. Permanent way special track work. Specifications and forms of tender from Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly.

October 11th. Board of Guardians. Twelve months' supply of electric lamps. Forms of tender from the Union Offices, All Saints', Manchester.

New Zealand. — Christchurch. — October 19th. Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*

Wellington.—November 2nd. Public Works Department. Electric generators and turbines. (B.X. 2622.) Indoor control gear and switchgear. (B.X. 2675.) 110,000-V transformer for Waikaremoana power scheme. (B.X. 2744.)*

November 23rd. Lightning arresters and transformers. (B.X. 2792.)*

November 30th. 110-kV transformers. (B.X. 2874.)*

January 4th. Switchgear and transformers for the Waikaremoana electric power scheme. (B.X. 2872.)*

December 10th. Government Railways. Electric motors. (B.X. 2861.)*

November 8th. Post and Telegraph Department. Diaphragms, cords, &c. (B.X. 2860.)*

New Plymouth.—October 16th. Harbour Board. One 30-cwt. portal electric jib crane, &c. (A.X. 3458.)*

Auckland.—October 11th. Electric Power Board. Ironclad switchgear and single-phase transformers. (B.X. 2793.)*

Invercargill.—December 1st. Southland Electric Power Board. One 3,200-h.p. horizontal Francis turbine and one 2,350-kW generator. (B.X. 2822.)*

Sheffield.—October 14th. Electricity Supply Department. One 10,000/12,500-kW turbo-alternator. (October 1st.)

South Africa.—CAPE TOWN.—October 20th. Electricity Department. Motors and starting switchgear for Brackenfel Quarry. (B.X. 2902.)*
South African Railways and Harbours. November 4th. One 40-ton electrically-operated Goliath crane. (A.X. 3657.)*

Thame.—October 11th. Board of Guardians. Installation of electric lighting at the Institution. (October 1st.)

Wolstanton (Staffs.). — October 23rd. Staffordshire County Education Committee. Electric wiring of Wolstanton Boys' New Secondary School. (October 1st.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Quetn Street, S.W.1.

Closed.

Australia. — MELBOURNE. — Melbourne and Metropolitan Tramways Board. Accepted :—
Conversion of the Prahran and Toorak cable tramways to electric traction (£113,653).—C. D. Timms. *Tenders.*

Barking Town.—Electricity Committee. Recommended: 2,680 yd. l.p. cable :—

Power & Lighting Cables, Ltd. (Deutsche Kabelwerke A.G.). (Recommended.)	**£1,482**
Hogan & Wardrop (Netherlands Cable Works)	1,496
Magna Wire & Cable Co. (Hackethal, Hanover)	1,539
Hackbridge Cable Co., Ltd.	2,010
Ateliers de Constructions Electriques de Charleroi	2,023
Enfield Cable Works	2,060
Callender's Cable & Construction Co., Ltd.	2,061
Siemens Bros. & Co., Ltd.	2,061
W. T. Henley's Telegraph Works Co., Ltd.	2,064
Standard Telephones & Cables, Ltd.	2,064
British Insulated Cables, Ltd.	2,065
Union Cable Co., Ltd.	2,070
Johnson & Phillips, Ltd.	2,073
Pirelli-General Cable Works, Ltd.	2,090

Cheltenham.—Electricity Committee. Accepted:—
Motor-driven induced-draught fan.—Davidson & Co., Ltd.

Denmark.—The Danish Office of Works and Public Buildings has accepted a tender for the building of a broadcasting station near Kalundborg. The tender was for 202,000 kr. (about £11,220).—*Reuter.*

Eastbourne.—Electricity Committee. Accepted:—
Compressor (£85).—Consolidated Pneumatic Tool Co.

East Ham.—Electricity Committee. Accepted:—
Fixing air lift pumping plant at the artesian well (£394).—C. Isler & Co., Ltd.

Failsworth.—Urban Council. Accepted:—
Installing electric light at 40 houses in Lord Lane.—Moston Brick and Building Co., Ltd.

Hastings.—Finance Committee. Recommended:—
Electric lift at Borough Council's offices (£587).—Express Lift Co., Ltd.

Hornsey.—Electricity Committee. Recommended:—
Troughs and bridges.—Albion Clay Co., Ltd.
Two economisers (£3,511).—Babcock & Wilcox, Ltd

Ilford.—Electricity Committee. Accepted:—
Battery for electric vehicle (£151).—Fuller's United Electric Works, Ltd.

Leicester.—Tramways Committee. Accepted:—
12 D.K., 40-h.p., 500-V d.c. tramcar motors (£2,592).—English Electric Co., Ltd.
Special track work (£1,244).—Hadfields, Ltd.
175 tons tram rails and 7 tons fish plates (£1,967).—Bolckow, Vaughan and Co., Ltd.

London.—MARYLEBONE.—Electricity Committee. Recommended :—
Electricity meters for 12 months.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.
Overhauling 8,000-kW turbo-alternator (£450).—General Electric Co., Ltd.
1,500-kVA transformer set for Messrs. D. H. Evans & Co.'s premises in Oxford Street.—British Electric Transformer Co., Ltd.

ADMIRALTY. Accepted :—
Inert cells, switch sockets and plugs.—Edison Swan Electric Co., Ltd.

Maidstone.—Electricity Committee. Recommended:—
5,600-kW Ljungström turbine with accessories (£23,046).—Brush Electrical Engineering Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
One 40,000-kW turbo-alternator, complete with house service alternator and condensing plant for Barton station.—Metropolitan-Vickers Electrical Co., Ltd.; sub-contractors for the condensing plant, Richardsons, Westgarth & Co., Ltd.
Two water-tube boilers with superheaters, economisers, air heaters and draught plant.—Babcock & Wilcox, Ltd
One 500-kVA, 3-phase static transformer.—British Electric Transformer Co., Ltd.
6,000 yd. weldless tubes.—Bromford Tube Co., Ltd
Street lanterns.—Simplex Conduits, Ltd.; Cable Accessories Co., Ltd.; Wardle Engineering Co., Ltd.
Batteries for electric vehicles.—Chloride Electrical Storage Co., Ltd.; D.P. Battery Co., Ltd.
L.p. cable for 12 months.—W. Geipel & Co., Ltd.; Standard Telephones and Cables, Ltd.; Macintosh Cable Co., Ltd.; Johnson & Phillips, Ltd.
Electric cookers for 12 months.—Cable Accessories Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Jackson Electric Stove Co., Ltd.
Quick-break switches.—J. H. Tucker & Co., Ltd.; J. A. Crabtree & Co., Ltd
Cut-outs.—Siemens & English Electric Co., Ltd.
33,000-V. 3-core cable.—Callender's Cable & Construction Co., Ltd.

Water Committee. Accepted :—
Booster plant at Broadheath.—Mather & Platt, Ltd.

Housing Committee. Accepted :—
Electric lighting installation at 116 houses on the Withington estate.—W. Spreadborough.

Salford.—Health Committee. Accepted:—
Rewiring certain blocks and the provision of new sub-mains at Ladywell Sanatorium (£1,443).—County Electrical Co., Ltd.

Electricity Committee. Accepted :—
Increasing the depth of the existing water troughs of the ash-removal plant at Agecroft power station, supplying two new chains and variable-speed motor (£1,636).—R. Dempster & Sons, Ltd.
Equipment for the new 6,600-V feeder cable from Agecroft power station to Prestwich (£565).—Metropolitan-Vickers Electrical Co., Ltd.
Cleaning cut battery at Frederick Road power station (£204).—Tudor Accumulator Co., Ltd.

Sheffield.—Electric Supply Committee. Accepted:—
Transformers (£2,876).—British Electric Transformer Co., Ltd.

Stirling.—Town Council. Accepted:—
Electrical work in connection with the St. Mary's Wynd housing scheme.—Lockhart & Macnab.

Willesden.—North Metropolitan Electric Supply Co. Accepted :—
One Venner-Shotter water-flow meter for measuring the condensate at the Willesden power station.—Venner Time Switches, Ltd.

Wingham.—
Installing electric lighting in the Parish Church, including engine, dynamo, &c.—Mr. Bigglestone, Canterbury.

Forthcoming Events.

Junior Institution of Engineers.—Friday, October 8th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "A Survey of Modern Airless Injection Oil Engines," by Mr. N. J. Griffin.
Friday, October 15th. Lecture; "China from the Engineer's Point of View," by Mr. R. L. Sarjeant.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, October 9th. At Neville Hall, Newcastle-on-Tyne. At 3 p.m. Address by the Branch President and Paper on "Cable Jointing," by Mr. E. E. Shatford.

Salford Technical and Engineering Association.—Saturday, October 9th. At the Royal Technical College. At 7 p.m. Lecture on "Sources of Inefficiency in Engineering Establishments," by Mr. R. A. Downs.

Institute of Marine Engineers.—Tuesday, October 12th. At the Institute, The Minories, E. At 6.30 p.m. Paper on "Double Acting Oil Engines," by Mr. W. G. Barn.

Batti-Wallahs' Society.—Wednesday, October 13th. At the Hotel Cecil, Strand, W.C.2. At 1 p.m. Re-union luncheon. Speaker, The Rt. Hon. Sir William Bull, Bart., M.P.

British Electrical Development Association.—Friday, October 15th. At The Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Lecture on "Wiring the Homes of Britain," by Mr. V. W. Dale.

Electrical Trades Commercial Travellers' Association.—Friday, October 15th. At The Old Colony Club, Aldwych House, W. C.2. At 7.30 p.m. Bohemian Concert.

Diesel Engine Users' Association.—Friday, October 15th. At Caxton Hall, Westminster, S.W. Paper on "A Note upon the Obligation of the Iron-founder to Diesel Engine Users," by Mr. H. J. Young.

Birmingham Electric Club.—Friday, October 15th. At the Grand Hotel, Colmore Row. At 7 p.m. Lecture on "Radio," by Mr. J. Entwistle.

Notes.

Electrical Association for Women.—On October 2nd, a beautiful Indian summer day, a party of 60 members and friends visited Mr. R. Borlase Matthews's all-electric farm near East Grinstead, and inspected the numerous uses to which electricity has been applied in his house as well as on the farm. An excellent tea, provided by Mr. Matthews, fittingly concluded one of the most enjoyable excursions yet experienced by E.A.W. members.

Legal.—ELECTRIC LAMP FRAUD.—The *Daily Mail* reports that, on September 29th, at the London Sessions, Paul Herman was charged with obtaining money by false pretences. It was stated that the prisoner had offered various people a "wonderful new lamp" which consumed only half the current of the ordinary type, while giving twice as much light. He charged from 10s. to 15s. each for the lamps, which were merely 100-V lamps, in districts where the supply was at 200 V. The lamps failed after running for a short time. Herman was sentenced to 18 months' imprisonment.

Appointments Vacant.—Electrical engineer for the Brighton County Borough Mental Hospital (£4); mechanician (£400) for the Posts and Telegraphs Department of the Government of Nigeria; assistant engineer for the Boston and District Electric Supply Co., Ltd.; lecturer and teacher in electrical design and (or) electrical distribution for the Goldsmiths' College, New Cross; clerk-draughtsman (£233) for the East Sussex County Mental Hospital; charge engineer for the Borough of Doncaster Electricity Department; editor for *Science Abstracts* (£500 to £750), for the Institution of Electrical Engineers. (See our advertisement pages to-day.)

Light as a Trade Force.—A lecture of interest to shopkeepers was delivered at the Town Hall, Hastings, recently on "Light as a Trade Force." There was a good attendance and among those present were the Mayor and Mayoress (Alderman W. J. Fellows and Mrs. Fellows). It was the first of a series of lectures arranged by the Hastings and St. Leonards Chamber of Trade to take place during the winter. In the course of his lecture, Mr. J. J. Jones advised that totally-enclosed lamps should be used, and recommended one to every 10 feet of floor space. A survey during last winter showed that in 80 per cent. of shops a great proportion of the light in the windows was wasted, illuminating the streets and lighting the ceiling of the window instead of the displays. The more light there was in a window the more impelling it became, and if possible the sources should be concealed by shields or other devices. A window should be far more brilliantly illuminated than the interior of the shop; about one 100-watt gasfilled lamp to every foot of window frontage.

The British Industries Fair, Birmingham.—As we have already stated, considerable extensions are being made to the British Industries Fair buildings at Castle Bromwich, Birmingham, giving a gross increase of 120,000 sq. ft. of space. The *Birmingham Post* states that, following the success of the recent Smoke Abatement Exhibition in Birmingham, a number of manufacturers who have not formerly exhibited outside the Metropolis, have decided to show their special apparatus and devices in the power and engineering sections of the Fair. In addition, the 25 firms which co-operated in the erection of the "Perfect Boiler House" at Bingley Hall are arranging to repeat the demonstration at the Fair.

Educational.—Aberdeen Engineering School.—Mr. David M. Kilgour, in submitting his annual review of income and expenditure in connection with Robert Gordon's College, stated that £8,932 had been spent during the financial year on the equipment of the new engineering laboratories. For the equipment of the new electrical engineering laboratories, the governors of the College had set aside a sum of £2,000.

University of London.—A course of eight lectures on "The Interaction of Pure Scientific Research and Electrical Engineering Practice" will be given by Prof. J. A. Fleming, F.R.S., at the Institution of Electrical Engineers, Victoria Embankment, on Wednesdays and Fridays in October and November, commencing on October 20th. Admission is free, without ticket. A detailed syllabus may be obtained on application to Mr. E. Deller, Academic Registrar.

The Dolgarrog Dam Failure.—As recently noted, the report of Sir Alexander Gibb & Partners to the Aluminium Corporation, Ltd., on the design and construction of the dams belonging to the North Wales Power Company has been completed, and by the courtesy of the Corporation we have been enabled to peruse it. The circumstances of the breakdown of the dams on Lake Eigiau and the Coedty Reservoir were recorded fully in our issues of November, 1925.

The report deals with the four lakes Eigian, Cowlyd, Llugwy, and Coedty, which have an aggregate capacity of 621 million cubic feet; Eigiau and Coedty have respectively capacities of 160 million and 11 million cubic feet. The Eigiau dam stands on glacial clay overlaid with peat, and in the opinion of the engineers the site is suitable provided that the wall is carried to a sufficient depth. The cross-section of the concrete wall is satisfactory, but its foundations are not carried deep enough to form an effective cut-off, and the concrete itself is of poor quality and not watertight. The proposals for the reconstruction of the dam include complete rebuilding at the breach, new reinforced-concrete facing and a watertight cut-off wall along the whole length of the existing wall, strengthening the concrete of the wall by grouting with cement under pressure, the replacement of the existing spillway by a new one 260 ft. long, and the improvement of the embankment at the northern end of the dam. The existing spillway is to be abandoned and the existing outlet arrangements are to be altered to enable discharge from Lake Eigiau to take place into the new Eigiau-Cowlyd tunnel, when completed, instead of into the Afon Porth Llwyd as at present.

The Coedty dam is stated to be convenient for a regulating reservoir. The ground consists mainly of firm glacial boulder clay, and is suitable for the construction of an earthen embankment with a reinforced-concrete cut-off and core wall such as has been adopted. The spillway is inadequate for exceptional flood conditions, and the cut-off wall is not entirely watertight. Proposals have been submitted to and approved by the Aluminium Corporation for the reconstruction of the dam at the breach in the earthen embankment, with a new cut-off and core wall; widening and raising the embankment on the down-stream side and raising the pitching on the up-stream side; heightening the wave wall by 3½ ft.; and replacing the spillway with a new one 300 ft. long, the sill being one foot lower than at present. Proposals are also made for strengthening the Cowlyd, Llugwy, and Llydaw dams.

According to the report, if the wall of the Eigiau dam had been built throughout of good concrete and taken to a depth of 6 ft. into the clay, the wall would probably have remained quite satisfactory. Examination on the spot indicates that the concrete is generally poor and in places very bad, the workmanship in placing it has not been satisfactory, and an excessive quantity of large stone displacers, carelessly placed, has been used. Excavations show that the bottom layer of sound concrete is overlaid with a layer of weak honeycombed concrete, through which water has percolated for a considerable time. Apparently some attempt had been made to improve the quality of the concrete after completion by the injection of cement grout under pressure.

In view of the liability to storms, which have disturbed the upper portion of the stone pitching, it is considered that the original pitching, 15 inches thick, is not heavy enough to resist wave action, and that the pitching should be strengthened where necessary.

We understand that the work of repair, which is in progress, should be completed within a few months.

Fatalities.—Richard Swan, locomotive fireman, of Tunbridge Wells, received a fatal electric shock while at work at East Croydon station of the Southern Railway on October 4th. He was breaking coal in the bunker of his engine when the head of the hammer came in contact with the overhead wire.

An inquest was held at the St. Pancras Coroner's Court on October 4th into the cause of the death of Alfred Pound, employed at the St. Pancras Borough Council electricity works. A workman employed in the boiler house stated that he saw Pound with a wheel spanner ascending for the purposes of opening the stop valve, but as the work was not carried out, a search was made for the deceased, who was found lying in the basement 50 ft. below. It was assumed that Pound slipped in crossing from one side of the girder to reach the valve. A verdict of "Accidental death" was recorded.

The Best Yet.—"Contact" gives in *The Motor* this amusing extract from an owner-driver's letter:—". . . . With regard to the new carbon brush which you recently fitted to my magneto, this could not have been a good one. I took it out yesterday, and found all the bristles have disappeared and only the black stump remains."

Faraday House Old Students' Association. — The eighteenth annual dinner of the Association will be held at the Hotel Cecil, on Friday, October 29th. Mr. Laurence J. Kettle, M.I.Mech.E., M.I.E.E., city electrical engineer of Dublin, and president of the Association, will be in the chair. Members of the Association are reminded that they may introduce guests, who need not be Faradians. A musical entertainment will, as usual, follow the dinner. Early application for tickets (price 10s. 6d. each), should be made to the hon. secretary (Mr. H. W. Fairman), Faraday House, Southampton Row, London, W.C.1.

Irish Electricity Supply Association.—Annual Meeting.—At the annual meeting of this Association, held in Dublin, the officers and Council were elected for the ensuing year, Mr. William Hewat being president; the hon. secretary is Mr. Laurence J. Kettle, Dublin Corporation. The report submitted dealt with the progress made in all parts of Ireland during the past year, and alluded hopefully to the prospects.

Junior Institution of Engineers.—Transformer Testing.—Mr. Leslie Smith, in a paper read before the Institution on October 1st, dealt with the subject of "Static Transformer Testing and Test Plant Requirements," referring briefly to some of the necessary characteristics of the rotating plant and the manner in which the required kVA output of it was settled.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. W. G. Smith, M.I.Mech.E., A.M.I.E.E., assistant mechanical engineer to the Manchester Ship Canal Company, has been appointed chief mechanical engineer in succession to Mr. Wm. Fox, who has resigned after 36 years' service.

The *Electrical World* reports that Mr. M. H. Aylesworth, managing director of the National Electric Light Association, has been appointed president of the National Broadcasting Co., Inc., which aims at establishing American broadcasting on a national and permanent basis.

The Minister of Transport has made the following announcement:—Mr. S. L. Pearce, C.B.E., having been offered the position of Engineer-in-Chief to the London Power Company consequent upon the retirement of Sir Alexander Kennedy, LL.D., F.R.S., has decided to accept that position. He has, therefore, tendered his resignation as a member of the Electricity Commission. The Minister of Transport has invited Mr. T. P. Wilmshurst, M.B.E., M.I.E.E., at present Electrical and Tramway Engineer to the County Borough of Derby and Chairman of the Engineering Consultative Committee of the East Midlands Advisory Board, to become an Electricity Commissioner, and Mr. Wilmshurst has accepted the appointment. It has been arranged for the changes to take place on November 1st. It is added that Mr. Pearce, while still consulting and chief engineer and general manager of the Manchester Corporation Electricity Department, was appointed as a member of the Advisory Expert Committee set up at the request of Lord Weir to review the technical scheme prepared by Sir John Snell for the Weir Committee. Subsequently, on the retirement of Mr. Page, he was appointed to be one of the Electricity Commissioners, and in both capacities he has rendered valuable service in connection with the preparation, and the committee and report stages, of the Electricity Bill now before Parliament.

Mr. WILMSHURST, a native of Retford, was educated at the King Edward VI School in that town, and commenced his engineering career as an articled pupil of the late Sir Charles Bright, who took so prominent a part in the laying of the first Atlantic cable. His first appointment was with the Taunton Electric Supply Co., Ltd., and from 1890 to 1893 he was chief engineer to the Exeter Electric Lighting Company. Entering municipal service as borough electrical engineer to the Halifax Corporation, he designed the power station and distributing system and supervised the execution of the work. He also installed a system of electric tramways. In 1898, Mr. Wilmshurst became chief electrical engineer to the Derby Corporation, and has remained in that post until now, having the remarkable record of 28 years' continuous service, during which the undertaking has developed under his control from an output of 491,000 to 29,000,000 kWh sold per annum, and has extended its operations into the surrounding districts, over an area of more than 100 square miles. The gross profit last year was £98,032, and the net profit £24,653.

Mr. Wilmshurst is a past president of the I.M.E.A., past chairman of the East Midland Centre of the I.E.E., past chairman of the Derby Society of Engineers, and chairman of the Engineers' Advisory Committee of the East Midlands Advisory Board. His war services in connection with coal control and

W. W. Winter] *[Derby.*

Mr. T. P. Wilmshurst, M.B.E., M.I.E.E., Electricity Commissioner.

munition work were recognised by the award of the M.B.E. His genial personality has gained for him a host of friends in all branches of the industry, and in his new sphere of activity as an Electricity Commissioner he will have ample scope for the exercise of his engineering ability and the administrative talents to which his past achievements bear witness.

At Upton, on September 29th, Mr. ALBERT VICTOR SWALLOW, chief chemist with the St. Helens Cable & Rubber Co., Ltd., was married to Miss IRENE PARKER, of Slough. The bridegroom received from the company and staff a canteen of cutlery.

At Maidstone, on September 29th, Mr. ALAN WILSON, electrical manager to Drake & Fletcher, Maidstone, was married to Miss G. F. SHELDRAKE, of Liverpool.

At its meeting on September 29th the Council of the University of Leeds appointed Mr. E. L. E. WHEATCROFT, M.A. (Cambridge), to the newly-created chair of Electrical Engineering. Mr. Wheatcroft's academic career at Cambridge was one of unusual distinction. His practical training was gained in the works of the British Thomson-Houston Co., Ltd., and later with the General Electric Company in America. He has had an extensive experience in certain phases of heavy electrical engineering (particularly in regard to problems relating to the generation and transmission of power) and has carried out a considerable volume of research work. In making this appointment the University has in mind the desirability of developing the Department of Electrical Engineering. Compared with some parts of the country Yorkshire has followed a progressive policy in the distribution of electrical power, and it is felt that this policy should be reflected in the attention paid within the University to the study of the scientific principles of electrical engineering.

To mark its appreciation of his work in connection with the development of the technics of telephony in Germany, the High School of Stuttgart has awarded the title of Hon. Dr. Ing. to Herr WILHELM KERSTEN, of the Telephon Apparat Fabrik Zwietusch Gesellschaft, of Charlottenburg.

The Oldham Corporation has increased the salary of Mr. R. WORCESTER, designer and superintendent of works, new generating station, from £450 to £500 per annum.

Obituary.—MR. Z. E. KNAPP.—We regret to record the death, which occurred on October 1st, at the age of 59 years, of Mr. Zac Ellis Knapp, M.Inst.T. Mr. Knapp, who was born in 1867, came to England from America in 1901 to take up an appointment with the Underground Railways. He was appointed general manager of the London United Tramways in 1910, and in 1913 he returned to the Underground Railways as chief engineer. Two years later he became manager for maintenance and construction. From March, 1917, to November, 1918, he acted as general manager of the Associated Equipment Company. At the end of 1918 he returned to the Underground Railways to again take up his post as manager for maintenance and construction, also acting at this time for a short period as commercial manager. In 1921 he was appointed director of construction, being responsible for the extension of the London Electric Railway from Golder's Green to Edgware, the reconstruction of the City and South London Railway by the enlargement of its tunnels, the extension of the City and South London Railway to Morden, and the extension of the Hampstead Section of the London Electric Railway from Charing Cross to Kennington. At the time of his death he was Director of Construction of the Metropolitan District, London Electric, City and South London and Central London Railway Companies. During his services with the companies he took a keen interest in the welfare of the staff.

M. P. HOSPITALIER.—The death is announced from Paris of M. Pierre Hospitalier, of the Compagnie d'Applications Mécaniques. He was a son of the late M. E. Hospitalier, of the French Ecole de Physique.

Wills.—The late Dr. J. T. BOTTOMLEY, D.Sc., F.R.S., chairman of Messrs. Kelvin, Bottomley & Baird, a nephew of the late Lord Kelvin, left £63,764 personal estate in Great Britain.

SIR H. S. LEON left £660,620 net personalty.

New Companies Registered.

Zenith Electric Co., Ltd. (216,536).—Private company. Registered September 30th. Capital, £26,250 in 25,000 ordinary shares of £1 each and 25,000 deferred shares of 1s. each. Objects:—To adopt an agreement with R. Lehmann & Co., Ltd., and to carry on the business of electrical engineers and manufacturing electricians and merchants referred to in the said agreement (being the electrical business formerly carried on as a separate department by the above company at the Zenith Works, Villiers Road, Willesden Green). The directors are:—C. T. Lehmann, Woldingham House, Woldingham, merchant (chairman); L. F. A. Fogarty, M.I.E.E., Dene Cottage, Manor Way, Ruislip, electrical engineer; G. P. Harris, 24, Haling Park Road, South Croydon, merchant; J. R. Lehmann, 5, Queen's Gardens, Ealing, W.5, merchant. Qualification, 50 ordinary shares. Remuneration (except managing director), £400 per annum divided between them. Solicitors: Thain, Davidson & Co., 23, St. Mary Axe, E.C.3. Registered office: Peninsular House, Monument Street, E.C.3.

Polo Battery Manufacturing Co., Ltd. (216,476).—Private company. Registered September 28th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electric battery and accumulator manufacturers, dealers in all kinds of electric batteries, accumulators, or other devices for the making or storing of electric current, &c. The subscribers (each with one share) are:—P. S. Edwards, 93, Angell Road, Brixton, S.W.9, solicitor's clerk; D. F. Coulson, 32, Collingwood Avenue, Muswell Hill, N.10, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitor and registered office: Albert M. Oppenheimer, 31, Queen Victoria Street, E.C.4.

Bailey & Incledon, Ltd. (216,539).—Private company. Registered October 1st. Capital, £2,000 in £1 shares (1,000 10 per cent. cumulative participating preference and 1,000 ordinary). Objects:—To adopt an agreement with G. Bailey and to carry on the business of electrical engineers as formerly carried on by him at 101, Great Russell Street, W.C., as "Bailey & Incledon," and to carry on the same and the business of manufacturers and sellers of electrical and scientific instruments, &c. The first directors are:—G. Bailey, Ashtree Cottage, The Glade, Shirley; H. J. North, 10, Rundell Crescent, Hendon (life directors). Qualification, £400. Remuneration, £200 each per annum (chairman £250). Secretary: H. J. North. Solicitors: Turner & Evans, 134, Chancery Lane, W.C.2. Registered office: 101, Great Russell Street, Bloomsbury, W.C.1.

The Incorporated Radio Society of Great Britain (216,431).—Registered on September 25th as a company limited by guarantee and not having a share capital, with an unlimited number of members, each liable for one guinea in the event of winding up. The word "limited" is omitted from the title by licence of the Board of Trade. The income and property of the Society whencesoever derived is to be applied solely towards the promotion of its objects. The objects are:—To take over such of the property, rights, and obligations of the existing Radio Society of Great Britain as may be lawfully acquired, to promote the general advancement of the science and practice of radio communication, &c. The subscribers are:—Brig.-Gen. H. C. L. Holden, 2, St. John's Park, S.E.3; M. Child, 60, Ashworth Mansions, Maida Vale, W.9, director of company; O. F. Brown, 13, Hampstead Way, N.W.11, civil servant; J. H. Reeves, 2, Penywern Road, S.W.5, tutor; J. R. Halliwell, 2, Princess Road, Crumpsall, Manchester, electrical engineer; G. M. Marcus, Queen's Park, Caterham, merchant; H. B. Lewett, 40, Kingsmead Road, S.W.2, electrical engineer. The management is vested in a council, the first members of which are not named. Secretary: H. A. Rock. Solicitors: Faithfull, Owen & Fraser, St. Michael's Alley, Cornhill, E.C.3. Registered office: 53, Victoria Street, Westminster, S.W.1.

Matthews Electric Signs, Ltd. (216,427).—Private company. Registered September 25th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of electricians, electrical engineers, manufacturers of electrical machinery and apparatus, &c. The subscribers (each with one share) are:—C. Bowen, 7, Ely Place, E.C.1, solicitor; I. L. Jones, 7, Ely Place, E.C.1, clerk. The first directors are:—B. G. Clark (chairman), R. F. Browne, and N. de M. Watsham. Qualification, £1. Remuneration, £5 each per annum (chairman £10). Secretary: H. Handley. Solicitors: De Buriatte & Bowen, 7, Ely Place, E.C.1. Registered office: Windsor House, Victoria Street, S.W.1.

Read Radio, Ltd. (216,522).—Private company. Registered September 30th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers, assemblers, erectors, installers, and repairers of all wireless telegraphic, telephonic and television apparatus, valves, instruments, &c. The subscribers (each with one share) are:—K. A. W. Barry 4, Embankment Gardens, Chelsea, S.W.3, civil engineer; F. O. Read, 26, Flanders Road, Bedford Park, W., radio engineer. The first directors are not named. Solicitors: Cohen & Cohen, 112, Salisbury House, E.C.2.

Official Returns of Electrical Companies.

A. E. Tribe & Co., Ltd.—Particulars filed of £500 debentures authorised September 21st, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £300.

Edward Dewhurst, Ltd.—Charge on 47, Fishergate, Preston, and mortgage on certain land and premises in Theatre Street, Preston, both dated September 1st, 1926, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd., respectively.

B. H. M., Ltd. (198,024).—Capital, £5,250 in 5,000 ordinary shares of 1s. each and 5,000 preference shares of £1 each. Return dated July 12th, 1926. 2,850 ordinary and 3,751 preference shares taken up. £3,096 paid on 1,700 ordinary and 3,001 preference shares. £807 10s. considered as paid on 1,150 ordinary and 750 preference shares. Mortgages and charges, nil.

Payne & Hornsby, Ltd. (197,444).—Capital, £5,000 in £1 shares. Return dated May 28th, 1926. All shares taken up. £5,000 considered as paid. Mortgages and charges, nil.

Hardman & Co., Ltd. (198,202).—Capital, £500 in £1 shares. Return dated June 30th, 1926. 480 shares taken up. £480 paid. Mortgages and charges, nil.

Sykes & Dyson, Ltd. (198,217).—Capital, £6,000 in £1 shares. Return dated June 3rd, 1926. 4,450 shares taken up. £1,230 paid. £3,220 considered as paid. Mortgages and charges, £1,149.

W. Robson & Sons, Ltd. (197,929).—Capital, £500 in £1 shares. Return dated June 28th, 1925 (filed April 7th, 1926). 400 shares taken up. £300 paid. £100 considered as paid. Mortgages and charges, nil.

Waterhouses (Electricians), Ltd. (197,960).—Capital, £500 in £1 shares (sub-division not stated). Return dated July 5th, 1926. 9 ordinary and 440 preference shares taken up. £449 paid. Mortgages and charges, nil.

John Adams, Ltd.. (197,965).—Capital, £7,000 in 1,000 ordinary and 6,000 preference shares of £1 each. Return dated May 14th, 1926. 300 ordinary and 2,000 preference shares taken up. £2,300 paid. Mortgages and charges, nil.

C. A. T. Cable Co., Ltd. (197,844).—Capital, £1,000 in £1 shares. Return dated December 31st, 1925 (filed March 24th, 1926). 6 shares taken up. £3 paid. £3 calls unpaid. Mortgages and charges, nil.

Monks & Byrne, Ltd. (197,620).—Capital, £2,500 in £1 shares. Return dated April 14th, 1926. 1,550 shares taken up. £900 paid. £650 considered as paid. Mortgages and charges, nil. Return of allotments made up to May 6th, 1926, shows a further 450 shares allotted for cash.

Rollas Electric, Ltd. (197,575).—Capital, £2,200 in 2,000 preference shares of £1 each and 4,000 ordinary shares of 5s. each. Return dated December 31st, 1925 (filed March 12th, 1926). 1,079 preference and 4,000 ordinary shares taken up. £904 paid on 904 preference shares. £375 considered as paid on 4,000 ordinary and 175 preference shares. Mortgages and charges, nil.

Basson Electrical Co., Ltd. (197,565).—Capital, £500 in 100 preference and 400 ordinary shares of £1 each. Return dated December 31st, 1925 (filed March 25th, 1926). 202 ordinary shares taken up. £202 paid. Mortgages and charges, nil.

H. E. Keen & Co., Ltd. (197,182).—Capital, £6,000 in £1 shares. Return dated July 7th, 1926. All shares taken up. £502 paid. £5,498 considered as paid. Mortgages and charges, nil.

Macfarlane Electrical Co., Ltd. (197,039).—Capital, £3,000 in £1 shares. Return dated July 7th, 1926. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Gilbert Productions, Ltd. (197,345).—Capital, £3,000 in £1 shares. Return dated February 12th, 1925 (filed March 15th, 1926). 2,191 shares taken up. £504 paid. £1,687 considered as paid. Mortgages and charges, nil.

Electro-Mechanical Supplies, Ltd. (197,243).—Capital, £3,000 in £1 shares. Return dated January 14th (filed March 16th), 1926. 999 shares taken up. £999 paid. Mortgages and charges, nil.

Wombwell Electrical Contracting Co., Ltd. (197,218).—Capital, £500 in £1 shares. Return dated July 1st, 1926. 357 shares taken up. £258 paid. £99 calls unpaid. Mortgages and charges, nil. Return of allotments made up to July 29th, 1926, shows a further 105 shares allotted for cash.

G. Gilliver & Co., Ltd. (196,438).—Capital, £1,000 in £1 shares (500 "A" and 500 "B"). Return dated December 31st, 1925 (filed April 12th, 1926). All shares taken up. £3 paid. £997 considered as paid. Mortgages and charges, nil.

Browett, Lindley & Co., Ltd.—Satisfaction to the extent of £2,000 on September 2nd, 1915, of first mortgage debenture stock (second issue), dated June 25th, 1909, securing £20,000. (Notice filed September 21st, 1926.)

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Ferranti, Ltd. The annual meeting was held on September 30th, Mr. A. W. Tait, C.B.E., the chairman, presiding. In proposing the adoption of the report, the chairman said the net profit for the year, after providing for all expenses and making the usual allocation of £15,000 to the depreciation reserve, was £59,765. The net profit for the previous year was £67,645, so that there was a decrease this year of approximately £7,900. The results were undoubtedly satisfactory when they considered the disturbing effect of the general strike and the coal dispute, and the consequent increase in costs and inability to get the required amount of raw materials. The trading profit was £148,502, as against £161,960, a decrease of £13,400. The turnover for the year again showed a substantial increase over that of the previous year, which was contributed by all the departments with one exception. There had been an increase in the meter department, both in quantity and value. It had been found necessary to accept lower selling prices owing to the keen competition in both the home and foreign markets, but notwithstanding that competition, they were still making satisfactory progress. The power transformer department had made very good progress and had not only shown a satisfactory increase in turnover, but also in profit. The instrument department showed some decrease in output, but they were giving that matter close attention which they hoped would have its effect in increasing orders. The radio department had made a satisfactory advance, the output being double that of the previous year. There was every reason to believe that their sales would show still further increases in the current year, and they had made arrangements recently for the development of the sale of their products abroad. Turning to the balance sheet, Mr. Tait said that they had spent £8,362 on additional buildings, and the expenditure on new machinery was £23,286. Stocks and stores and expenditure on work in progress showed an increase of £38,323, which was due to the increase in the turnover of the business. They had transferred to the general reserve £35,000, increasing the amount to the substantial total of £200,000, which was almost equal to the total issued preference and share capital. The position of the company was very sound, and the progress made during the year was satisfactory, considering not only the keen competition which existed, but also the difficulties of manufacture which had been experienced in consequence of industrial unrest. That was bound to have affected their costs, but he trusted that the greater part of that would be removed by the extensions which were now in course of erection at Hollinwood, and by certain other arrangements which they were making for the acquisition of further buildings in their own works. That would substantially increase their productive capacity, which would enable them to deal in an efficient manner with the increasing demand for their products. He could not make any forecast with regard to the current financial year, except to say that they had a satisfactory order book and that notwithstanding the present difficult trading conditions they hoped that they would obtain their fair share of the growing demand for electrical products, both here and abroad. Mr. R. W. Cooper seconded the motion, which was carried.

Burndept Wireless, Ltd. An extraordinary general meeting was held last week, under the chairmanship of Sir George C. Hamilton, to consider a resolution empowering the board to borrow £50,000 by the issue of debentures. The chairman explained that the company found itself, at the beginning of the season, short of cash and unable to carry out the large selling campaign which had been planned. Advertising was essential, and it was in the company's interest to borrow the money necessary for the scheme. The prospects were good, and the number of orders taken at the recent exhibition had considerably exceeded those secured last year. The resolution was unanimously carried.

During this week the directors offered 500 7 per cent. debentures of £100 each, constituting a first floating charge, subject to the existing charge in favour of the company's bankers. The debentures will be redeemable on June 30th, 1929, at a premium of 6 per cent., or earlier at a premium of 3 per cent.

German Companies. The *Rheydt Cable Works Company*, Rheydt, proposes to make a distribution of 12 per cent. for 1925-26, as compared with 15 per cent. in the preceding year.

The *Electricity Company* (late *Lahmeyer and Company*), Frankfort-on-Main, records net profits of 1,878,000 marks for 1925-26, as compared with 1,608,000 marks in the previous year, the rate of distribution proposed being 9 per cent., as against 8 per cent. in 1924-25.

The directors of the *Electric Light and Power Investment Company*, Berlin, recommend the payment of a dividend at the rate of 10 per cent. per annum for the nine months forming the new financial year ended with June 30th, 1926. The present prospects are stated to be favourable.

The *Poege Electricity Company*, Chemnitz, reports a further increase in the turnover in 1925-26. A notable improvement took place in the foreign trade, although the prices realised were frequently unsatisfactory. After making a larger provision for depreciation than in the previous year the accounts show net profits of 220,000 marks, as compared with a slight loss in 1924-25. It is proposed to pay a dividend on the ordinary shares of 6 per cent., as against nil in 1924-25, and at the same rate on the preference shares for the past two years.

The *German Electricity Works Company* (*Garbe, Lahmeyer and Co.*), Aix-la-Chapelle, reports that considerable orders were booked in the first half of 1925-26 but the improvement was not maintained in the second half, competition having rendered impossible the obtaining of adequate prices. The net profits amount to 127,000 marks, permitting of the reduction of the loss brought forward to 394,000 marks. Although no material change has taken place in the new financial year, there are now said to be indications of an improvement.

The shareholders of the *Brown, Boveri Co.*, Mannheim, have agreed to an increase in the capital from £250,000 to £750,000.

French Companies. The *Société des Accumulateurs* (*A. Dinin*) reports net profits amounting to 3,544,000 fr. for 1925-26, as compared with 3,012,000 fr. in the preceding year. It is expected that the dividend will be at the rate of 22 fr. per share, as against 18 fr. in 1924-25.

The report of the *Etablissements Industriels de E.C. Grammont et de Alex. Grammont*, whose accounts were summarised recently, states that the technical agreements entered into with the Western Electric Company will ensure the collaboration of the latter in the French company's share in

the construction of automatic telephone exchanges in Paris, now the subject of competition. It is also mentioned that the company participated in the construction of the telephone cable between Paris and Le Havre, which is about to be placed in service.

The Loewenstein Scheme.

The *Financial Times* reports that, in connection with the Loewenstein power merger, a company has been incorporated in Canada, under the title of the Hydro-Electric Securities Corporation, with a capital of $25,000,000 in 5 per cent. gold bonds and a similar amount in 6 per cent. preference shares; there are also 2,000,000 ordinary shares of no par value. An issue of part of the capital will be made shortly, presumably for the purpose of acquiring the holdings of the Société International d'Énergie Hydro-Electrique ("Sidro"). Brazilian Traction, Barcelona Traction, and other shares held by interested groups will be exchanged for new shares and a cash payment.

Metropolitan Electric Supply Co., Ltd.—In a recent circular the directors state that the company's Willesden station has been sold to the London Power Co. under the terms of the London Electricity (No. 2) Act. The 3½ per cent. debenture stock, £378,000 of which is outstanding, is secured by a charge on a section of that station. It is proposed to exchange each £100 of this stock for £105 of British Government 3½ per cent. conversion loan. A meeting of the stockholders is to be held on October 21st to consider the proposal. It is reported that Mr. A. W. Tait, C.B.E., has resigned his trusteeship for the holders of the stock and that his place as joint trustee with Mr. W. Sandford Poole has been taken by Lord Wargrave.

Bromley (Kent) Electric Light and Power Co., Ltd.—The report for the year ended December 31st last states that the Bromley Town Council has given notice of its intention to resume possession of the undertaking in accordance with the provisions of the deed of transfer. The result of the year's trading was a surplus of £19,469, to which was added £639 brought forward, making £20,108. The directors recommend a final dividend of 6 per cent., free of tax, making 10 per cent., tax free, for the year, leaving £11,108 to be carried forward. Meeting: October 11th.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

West London and Provincial Electric and General Trust.—43,446 new ordinary shares of £1 each, 2s. 6d. paid and fully paid, within Nos. 11,426 to 12,925, 15,026 to 16,025, and 25,855 to 70,000; 28,964 new 6 per cent. cumulative preference shares of £1 each, 2s. 6d. paid and fully paid, within Nos. 49,078 to 80,000; 3,200 new ordinary shares of £1 each, 10s. paid and fully paid, within Nos 11,426 to 12,925, 15,026 to 16,025, and 25,855 to 70,000; 1,959 new 6 per cent. cumulative preference shares of £1 each, 10s. paid and fully paid, within Nos. 49,078 to 80,000; 7,700 ordinary shares of £1 each, fully paid, Nos. 1 to 7,500 and 25,655 to 25,854; 7,600 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 7,500 and 36,046 to 36,145.

Marconi's Wireless Telegraph Co., Ltd.—We reported recently that a letter had been sent to shareholders alleging that the scope of the investigation into the company's affairs by the auditors had been restricted by the board. The board has now refuted this statement, and with regard to the suggested formation of a shareholders' committee, says that their interests will best be served by refraining from action of that kind.

Venezuela Telephone and Electrical Appliances Co., Ltd.—The proposal to sell the company's undertaking to a Venezuelan purchaser for £425,000 was unanimously approved by a meeting of shareholders on October 4th. Mr. J. S. Austen, who presided, said that the offer was a favourable one and would result in a distribution of not less than 27s. 6d. per share. As soon as the money was received the board would take the earliest steps to wind up the company.

United River Plate Telephone Co., Ltd.—The *Financial Times* states that an issue of new ordinary shares at par will be made in a week or two in the proportion of one new share for each six held. The authorised capital is £5,000,000, of which £4,760,000 has been issued in the form of 912,000 ordinary shares and 40,000 preference shares of £5 each, fully paid.

Parsons Marine Steam Turbine Co., Ltd.—There was a loss on the past year's working, but after crediting royalties and dividends from investments there was a profit of £11,725. With £30,463 brought forward, the amount available is £42,189. The directors recommend a dividend of 5 per cent., tax free, leaving £31,625 to be carried forward.

Cia de Electricidad de la Provincia de Buenos Aires.—It is reported that this company proposes to raise its capital from £787,500 to £1,137,500 by the creation of 350,000 8 per cent. non-cumulative participating preference shares of £1 each. The new shares will rank next after the pre-preference shares.

Stanton Ironworks Co., Ltd.—A dividend at the rate of 6 per cent. per annum has been declared on the preference shares for the half-year ended September 30th.

Pritchett & Gold & E.P.S. Co., Ltd.—An interim dividend at the rate of 10 per cent. per annum, free of tax, has been paid on the ordinary shares, as in 1925.

Lancashire Electric Light and Power Co., Ltd.—The half-yearly dividend to September 30th has been declared on the 7 per cent. cumulative participating preference shares.

British Electric Transformer Co., Ltd.—The accounts for the half-year to June 30th show a profit of £22,906, as compared with £25,826 for the first half of 1925.

Stocks and Shares.

MONDAY EVENING.

CITY circles are a good deal intrigued by the ambitious schemes of which the redoubtable Mr. Alfred Loewenstein is credited with being the originator. Not only in London, but in Montreal, Toronto and New York, a good deal of attention is being paid to the talk of a huge amalgamation of interests declared to have been reached between some of the principal Latin-Canadian companies. Of these, the names are mentioned of the Shawinigan Light and Power, St. Maurice Power, Montreal Light, Heat and Power, two or three companies whose names are less familiar on this side, and a number of others which are related more or less intimately to the Brazilian Traction group. The advent of a new company is expected to be announced, within the next few days, with a capital that will look stupendous. The names mentioned in connection with the deal are those of well-known and responsible men in Canada, and the effect of the statement has been, during the past few days, to bring about advances in Shawinigan and some of the other shares in companies connected with the business. So far as the Brazilian Traction group is concerned, interest has slightly died out for the moment, Tractions being easier on the week and Barcelona Tractions easing off to 40¼. Sidro shares are 13. Mexican issues show few changes, and none of any consequence. Georgia Light and Power shares advanced to 67½, Pennsylvania Water and Power to 172¼.

A decided feature to-day (Monday) has been a recovery in the price of Marconi shares. This occurred after the Stock Exchange Official List had been made up, and consequently the quotation in the latter remained at 13s. 9d. The price of the ordinary has strengthened, however, to 14s., and the preference hardened to 21s. 3d. No particular reason was assigned for the improvement other than the vague hope that the report of the auditors would be out shortly. This factor was considered not very long ago as likely to prove a reason for depression. Possibly there may have been "bear" selling in anticipation of its coming, and the short interest is notoriously fidgety. According to a report in well-informed quarters, the auditors' statement is likely to be one which will show drastic reorganisation to be necessary. For this, the proprietors of Marconi shares are already prepared. The Marconi directors have issued an effective reply to the demand lately made for the appointment of a shareholders' committee.

Electricity supply shares are steady and rather better than the nominal quotations suggest. For instance, Kensingtons are nearer 14 than 13¾ and St. James's are actually 16¼. Urban preference are a little harder at a guinea; Bournemouths, after touching 60s., eased off to 58s. 3d. Electric Supply Corporation shares have recovered the amount of the dividend deducted last Thursday. London Power debenture can be bought at 98¾ cum dividend, a price which, by the way, is higher than quotations which rule for some of the Australian Colonies' full trustee stocks. The conclusion of summer-time, and reinstitution of Greenwich time, have come about unmarked by price changes either in electricity shares or gas stocks.

Telegraph Constructions are again better at 30, showing a rise of 10s. on the week. This is the highest price that has been touched by the shares for years past. The buying is associated with the impression that the company will shortly increase its dividend, or, what seems to be more likely, will present the proprietors with a bonus in some shape or other.

Siemens have gone back to 30s. General Electrics are easier at 30s. 3d. English Electrics drooped to 15s. 6d. The rest of the list is inclined to be dull, for which the reason assigned in the market is that shareholders have been rendered a little uneasy by the long-continued nature of the coal stoppage, and the fear lest the difficulty of obtaining fuel may be reflected in the next dividend announcements. Anglo-Portuguese Telephones are a feature of strength at 13s. 9d., a good deal of business having been transacted in the shares during the past few days. Some of the buying is known to have come from Lisbon. Eastern stocks and shares have not changed. United River Plate Telephones are ¼ better at 8¾; the new issue of shares at par, in the proportion of one for every six shares now held, will be out next week.

Underground Electric Railway issues are good, with rises in Districts, Metropolitans, Underground £10 shares, and income bonds. A few of the tramway descriptions firmed up, London and Suburban preference being harder at 5s. 6d. British Electric Tractions keep very steady.

Bromley (Kent) Electric ordinary remain at 34s., unaffected at present by the notice given to the company by the Bromley Town Council that the latter intends to resume possession of the undertaking. This the Council has the right to do at the end of each seven years, at cost price, plus premiums that vary with each period, and after making allowance for depreciation. The directors have declared the usual final dividend of 6 per cent., making 10 per cent., tax free, for the year.

Babcocks at 53s. 9d. remain amongst the firmest shares in their section. The tendency for iron, coal, and steel descriptions is upward: speculation seems to be looking a long way ahead. Rubber shares display an inclination to improve, although the market for the raw produce is very sluggish. Stock Exchange business as a whole is best described as patchy; there is some fear of a tightening of money rates in the near future, and this acts as a drag upon investment enterprise.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	1925.	Price Oct. 4 1926.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	58/3	−1/2	4 16 2
Brompton Ordinary	1	10	10	1 5/8	—	5 12 2
Charing Cross Ordinary	1	15	15	44/6	—	6 14 10
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	49/6	—	6 1 3
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	58/3	—	5 3 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/-	—	6 3 1
do. 7% Pref.	1	6	7	22/6	—	6 4 5
Elec. Supply Corporation	1	10	10	31/8xd+6d.		6 8 0
Kensington Ordinary	5	15	15	13⅝	—	5 9 1
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 8
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅜	—	5 6 10
South London	1	15	15	2⅜	—	5 9 1
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	7	1 7/8	—	5 17 11
do. 6 % Pref.	1	6	6	21/-	+6d.	5 14 3
Westminster Ordinary	1	15	15	2⅛	—	6 13 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6
Home Rails.						
Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	62	+½	8 1 4
do. District	,,	3½	3½	53	+1½	6 12 1
Underground Electric Ordinary	10	Nil	Nil	4	+¼	Nil
do. do. "A"	1/-	Nil	Nil	12/-	—	Nil
do. do. Income	Bonds	6	6	101	+1	*5 18 10
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 5
do. Def.	,,	1½	1½	24⅜	—	6 1 3
Automatic Telephone	1	3	10	21/-xd+6d.		3 16 0
Chili Telephone	5	5	6	6¾	—	4 7 4
Cuba Sub. Ord.	10	5	5	7½	—	6 18 0
Eastern Extension	10	10	10	19½xd	—	*5 4 8
Eastern Tel. Ord.	Stock	10	10	190½	—	*5 5 0
Globe Tel. and T. Ord.	10	10	10	19	—	*5 5 3
do. do. Pref.	10	6	6	11xd	—	5 9 1
Great Northern Tel.	10	22	20	27½	—	7 5 6
Indo-European	25	8½	10	47½	—	*5 5 0
Marconi	1	10	Nil	13/9	—	... ...
Marconi-Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	46/3	—	*5 3 10
United R. Plate Tel.	5	8	8	8⅜	+¼	*4 15 7
Western Telegraph	10	10	10	18⅜	—	*5 7 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3	—	9 3 4
do. do. 2nd Pref.	5	6	6	2½	—	11 3 2
do. do. 5% Deb.	Stock	5	5	76	—	6 11 7
British Electric Traction Ord.	,,	7	8	140	—	5 14 4
do. do. 6% Pref.	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	122½	−1½	4 1 8
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—.	5 15 7
do. do. Preferred	,,	96/-	126/9	113⅛	—	*5 12 0
do. do. Deferred	,,	129/5	8	140	—	*5 14 4
do. do. Deb.	,,	4½	4½	77½	—	5 7 7
London & Sub. Trac. 5% Pref.	£1	2½	Nil	5/8	+6d.	Nil
London United Tram. Deb.	Stock	4	4	44½	—	8 19 10
Mexico Trams, 5% Bonds	—	5	5	66½	—	7 7 1
Mexican Light Common	100	Nil	Nil	94	—	Nil.
do. Pref.	100	Nil	Nil	85½	—	Nil
do. 1st Bonds	—	5	5	70	—	7 2 10
Yorkshire (West Riding)	£1	5	—	11/6	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	£1	12	13	2½	—	4 16 9
British Aluminium Ord.	1	5	10	47/-	—	4 5 1
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	3½	—	4 5 9
Brush Ord.	1	10	10	27/-	+9d.	7 8 2
Callenders	1	15	15	3⅜	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/8	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	31/9	—	6 6 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	15/6	−9d.	... ...
do. do. Pref.	1	6	6	17/6xd	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	7½	30/3	−9d.	4 19 2
Henley	1	16	20	4½	—	4 16 10
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0*
India-Rubber	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	66/3	—	5 5 8
Met.-Vickers Ord.	1	8	8	25/9	—	6 4 9
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	1½	−⅛	5 0 0
Telegraph Construction	12	20	10	30	+½	*4 9 9

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price Oct. 5th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	6¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¾d. to 3⅞d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£273	£5 inc.
Grade II	,, ,,	£194	£3 inc.
Grade III	,, ,,	£101	£1 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	...
c ,, Tubes (solid drawn)	,,	1/0 to 1/0½d.	...
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£66 15s.	£1 dec.
d ,, ,, Sheets	,,	£14 10s.	...
d ,, ,, Wire Rods	,,	£76 15s.	£1 dec.
d ,, ,, H.C. Wire	per lb.	9¾d.	...
f Ebonite Rod	,,	2/3 to 4/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/8½	½d. inc.
i Iron Pig (Cleveland No. 3.)	per ton.	72/6	...
i ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£32 10s.	£1 dec.
g Mercury	per bot.	£15 17s. 6d.	...
		£15 10s.	...
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/0½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire	,,	1/4	...
o Platinum	per oz.	£23 10s.	...
d Silicium Bronze Wire	per lb.	11d.	½d. dec.
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£315 to £316 5s.	£5 to £5 5s inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/5	2d. inc.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

B.E.S.A. Publication.—The British Engineering Standards Association has issued a specification for indicating ammeters, voltmeters, wattmeters, frequency- and power-factor meters (No. 89-1926). This revised specification is more complete than the 1919 issue, which is superseded by the new edition; it provides for instruments having sub-standard first- and second-grade accuracy, and among the additions the following may be specially noted:—A clause has been included to provide for satisfactory damping. The table of accuracies has been amplified, and, in common with most of the clauses of the specification, exhibits a tendency to make the requirements more stringent. The new specification provides for a dynamometer wattmeter of special accuracy, having been introduced for use particularly in acceptance tests of electrical machinery. A clause has also been inserted specifying tests for wattmeters and power-factor meters for use on unbalanced 3-phase loads. An appendix deals at length with the accuracy to be expected of different types of instruments, a subject upon which but little information has hitherto been available; suitable methods of testing instruments are also dealt with. Another appendix gives the drilling centres recommended for shunt ends, based upon recent research which has shown that a large contact area is not in itself a sufficient criterion. A very complete scheme of terminal markings has been drawn up with the object of ensuring uniformity in diagrams of connections issued by different makers. A further point of interest is the note in the specification which draws attention to the fact that British manufacturers may be licensed to use the trade mark "BESA" to indicate that the instruments are guaranteed to comply with the specification. Copies of the specification (No. 89-1926) may be obtained from the B.E.S.A., Publications Department, 28, Victoria Street, S.W.1, price 1s. 2d., post free.

The World Power Conference.—V.

Electro-Farming.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

One of the outstanding, and yet, possibly, unexpected, successes of this Conference was the Section relating to the subject of "Electricity in Agriculture." Not only were the sectional meetings attended by very large numbers, in spite of the competing interest of a simultaneous meeting on "Railway Electrification," but also the two sessions originally allotted for the work of this section had to be extended to yet another session and, in addition, time was found for the display of three electro-farming kinematograph films. Of the latter, one was that prepared by the British Electrical Development Association of the author's all-electric farm at East Grinstead. This created a very favourable impression amongst the Continental engineers, who, it must be admitted, have made considerably greater progress in rural electrification than those in this country. Dr. A. Ekstroëm exhibited a film of his farm, illustrating modern methods of transporting materials in agriculture. Such methods are still quite new to Great Britain, and such a film emphasises the need for their installation, for the British farmer often spends as much as the value of the material that he is providing his livestock with, in merely handling this stuff. Distribution, therefore, to him represent a very serious on-cost. The vehicles in which the crops are placed in the field have first laid in them special poles provided with steel ropes, so arranged as to tie the load together, so that when the cart arrives at the barns, the whole load is lifted off the cart in one operation by a simple form of Temperley transporter, which elevates it and then transports it to the required position in the barns, or delivers it direct on to the feeding table of the threshing machine. The threshed grain, the chaff, and the straw, as they are delivered from the threshing machine, are conveyed by means of electrically-driven fans to the granary, chaff room, and straw stack respectively, thus cutting out a great deal of manual labour. Dr. Ekstroëm is going to read a paper on this general subject during the next session of the Institution of Electrical Engineers.

Prof. Stewart showed an American film to illustrate the developments that are taking place in that country. This film illustrated very clearly the very advanced position of the electrical equipment of the American farmhouse, which is evidently far ahead of European practice; but when it came to the equipment on the farm itself, it was soon appreciated that America had much to learn from Europe in this respect. However, that country is evidently tackling the whole electro-farming problem in a very serious manner, for Prof. Stewart mentioned that no fewer than three ladies and 23 men were devoting their entire time to the development of this special branch of work. Also very large sums of money had been set aside to facilitate these investigations.

Several of the speakers emphasised the fact that the equipment of the farmhouse and of little villages and hamlets, which are, after all, dependent upon the farms in the area in which they are situated, must essentially be considered as part and parcel of the rural electrical distribution scheme. Further, if the best workmen were going to be retained in the country, they must be provided with the comforts of civilised city conditions, many of which, they maintained, modern electrical domestic appliances could furnish. Further, the load obtained in this way was a welcome addition to the ordinary farm load. Hence Dr. Ekstroëm's contribution to the discussion by his description of the Swedish thermal storage cooker (which was described in the Electrical Review of September 17th, 1926, p. 473) created a great deal of interest, as generally it is of great importance to improve the load factor on rural-distribution networks, just as it is in towns.

The only pessimist who took part in the discussion was Mr. L. J. Kettle, of Dublin, but even he admitted, as the result of having lived in Switzerland for some time, that, at any rate, the Swiss would not electrify their farms unless they thought there was money in it. In the neighbourhood of Lucerne, 95 per cent. of the farms have an electricity supply, while in the immediate vicinity of Zurich over 4,100 electric motors are installed on farms.

One of the great objections that is raised against rural electrification is that of necessity overhead lines must be employed. However, these lines are not nearly so noticeable as many people are apt to imagine. In fact, it takes a little attention and care to pick out the posts on a patch of countryside when one's notice is drawn to the matter. With regard to a question put to a number of the British members at the Conference, the writer found the general opinion was that usually these lines were not at all obtrusive; had the insulators been universally of glass or green porcelain, they would have been even less visible. Mr. T. Petersen admitted that such an effective distribution would probably have never been brought about, if cables alone had had to be depended upon. Not being contented with the expression of opinion of the mere male mind, the writer took the opportunity of asking some of the ladies of the party what they thought about the situation. Lady Anne Snell and Mrs. Roger T. Smith both independently said that it was really difficult to see the lines, even when attention had been drawn to them, as they blended so well with the orchards and other trees, which are such a characteristic feature of Swiss rural scenery. In fact, they and others agreed that the overhead lines, at any rate, had not interfered with the beauties of Switzerland.

As was the case with all the other sections of the Conference, the reports presented from each country were summarised in one general analysis. In the case of electricity in agriculture, Mr. F. Ringwald, who is himself an authority on the subject, was the reporter. Except for the single instance of the British paper, the reports dealt with a general survey of the progress of electro-farming in each country, and attention was drawn to points of outstanding interest. The British paper dealt with the subject of electric ploughing, as the general situation had been gone into pretty carefully at the last World Power Conference in London. However, at the invitation of the President, the last report was brought up-to-date by a reference to the work of the committees of the Institution of Electrical Engineers and of the Electrical Development Association, and also of the two Electro-Farming Conferences that had been held by the Electrical Development Association. Other British work was also touched upon, such as that of the Electro-Culture Committee under the chairmanship of Sir John Snell, with its experimental work at Rothamsted and Lincluden. Another British body that is taking an interest in the matter is the Rural Reconstruction Association, as one of the planks of its platform is the electrification of the countryside. Then mention was made of some of the areas wherein electro-farming is being encouraged, such as South Wales, Chester, Mid-Cheshire, Kilmarnock, Fife, Aylesbury, Hereford, &c. The paper on "Electric Ploughing" was very much more detailed and technical than a previous one presented by the same author before the British Association this year. Some very interesting particulars were included as to the costs of ploughing,

concerning which so many people are anxious to obtain particulars at present. Altogether there are over 200 electric ploughs in use in Europe. As the greater part of the demand for power by the farmer is for work on the land, it is a most important question whether or not that work can be done electrically. There are, of course, a number of difficulties in the way, but upon analysis it is found that the chief one is that the apparatus is different to that to which the farmer is normally accustomed. Hence, it is largely a matter of overcoming prejudice in those parts of the country where supply lines already exist. This paper produced some very interesting particulars from M. Bitouzet, the French representative, who described the special company that had been formed by the electric light companies in the neighbourhood of Paris, to consolidate all the various electric ploughs at work in their area, with a view to more economical use and adding to their numbers. For this purpose, central storing yards and workshops are being started in fifteen centres, each of which will in the first place supervise the operation of three or four ploughs. Seven are at present in operation, and already the amount of electrically-ploughed land is very considerable.

Professor Stewart, in the absence of Doctor White, representing the National Committee for the Relation of Electricity to Agriculture in the United States, took exception to the general reporter's expression of opinion that America was so backward in the application of electricity to farming purposes. He pointed out the tremendous amount of energy that was being used, especially in California, for irrigation work for farmers. Doctor M. Kano mentioned that nearly half a million horse-power was now required in Japan for draining and irrigating what was previously marshy and desert land. This work was of very great importance on account of the increase in population of 600,000 to 700,000 annually. Hence the provision of more rice fields was very essential. In order to avoid the serious damage caused by caterpillars to the rice, very successful efforts had been made to destroy the moths before they laid the eggs that developed into the caterpillars. This was accomplished by attracting the moths at night by means of electric light, pans of water being placed under the lamps to drown the attracted moths.

Mr. A. E. Kitson, of the Gold Coast, in the course of an optimistic speech concerning the many possible applications of electricity to agriculutre in the tropics, referred to the employment of ultra-violet light for the destruction of vegetable insect parasites.

Professor Stewart also mentioned that it had been discovered in America that the treatment of food by ultra-violet light had the same effect on the animal which consumed that food as treating the latter directly with the light.

Mr. A. E. Kitson suggested a number of new applications of electricity for the drying of copra, cocoa nibs, tea leaves, and other products of equatorial countries.

Mr. E. Velander dealt, in a very capable manner, in three languages, with the use of electric light in Sweden for the treatment of plants. The writer also gave some particulars of his work in connection with the very intensive illumination of greenhouses.

Dr. Vietze, of Halle, Germany, in the course of a very excellent speech, pointed out the importance of electricity as an aid in bacterial control, which was obviously such an important feature of many farming operations. Over a thousand electric silos have been installed in Germany so that the practice of electric silage has long passed the experimental stage in that country. During the threshing season in Germany, the maximum load for that purpose alone is already 400,000 kW. It is anticipated that the agricultural demand in Germany will very shortly rise to between three and four thousand million kWh per annum.

Among many of the subjects to which reference was made by various speakers were the rapid extension of milking machines and some of the difficulties that had to be overcome to ensure their success, which was easily obtainable when the machines were rightly used, in which case there was no question of any damage to the animals.

The artificial watering of fields and market gardens is extending, as well as the distribution of liquid manure over the fields by means of permanent underground pipes.

The electric boiling of pig food already provides an enormous load in some countries. Electric incubators are growing in popularity, and in addition to dealing with the eggs of various kinds of poultry, they are now also employed for silk-worm eggs.

The sterilisation of milk by ultra-violet rays is evidently making some progress. The field for the use of electricity in the preparation of cider, perry, &c., and also in the preservation and desiccation of fruit is increasing. The artificial making of hay and the drying of sugar beet were other matters that received due consideration. In fact, judging from the papers, the discussions at the meetings, and personal interviews there is undoubtedly a great deal of patient effort being exerted to search out every possible use of electricity that could be made an aid to the farmer.

The question of accident prevention arose, as it was felt that already on farms very considerable risks were taken in the ordinary routine, and it would not therefore do to add any possible electrical troubles. It was recommended that power should be cut off at the proper place before any repairs were started, and that preferably the farmers and their men should be dissuaded from carrying out their own electrical repairs.

Naturally the question of tariffs came under consideration, but no very new light was thrown upon the situation. The general feeling seemed to be that charges to farmers should be on some basis of a predetermined sum, plus a very low rate per unit. Some very complicated systems are in existence. For example, on one farm near Zurich the writer discovered five meters and two time clocks; one of the meters had three sets of dials, another had two sets, and the rest one. That sort of thing is not going to popularise electricity among the rural community.

The general reporter—Mr. F. Ringwald—made the suggestion that there should be National Committees to study the general subject of electro-farming in each country, and also an International Committee. This proposal was supported by the writer, who had the honour, as the British representative, of reading the opening paper of the Sessions. It met with the approbation of various speakers, and it was accordingly decided to put the suggestion before the Executive Council of the World Power Conference.

Thus electro-farming was received very enthusiastically at the Conference. Its position is greatly strengthened thereby, and undoubtedly the discussions will set more minds at work in many countries to push on progress in what is, after all, a most important matter, since the wealth of every nation is ultimately dependent upon her agricultural resources.

Steam-Pipe Tests.—In a paper on "Steam Pipes for Extra-High-Pressure and Temperature," read before the Institute of Marine Engineers by Mr. J. A. Aiton, C.B.E., some interesting particulars are given of a case of corrugated and plain-type steam bends being subjected to severe vibration. The bends were used in conjunction with a 50-ton steam hammer which, on account of the method of working, was subject to excessive vibration. When first started to work, steam was supplied to the hammer by a 5-in. plain-steel bend; the vibration was so great that the steam chest was broken off. A stronger chest was fitted and the steam connection made through a copper bend. The life of these bends was so short, not more than a month, that replace bends had to be kept in stock, and the steam joints had to be re-made on an average once a day. A 5-in. corrugated bend, 24 in. by 20 in., made from stock solid-drawn hot-finish tube, 7/32 in. thick, was fitted, and after working for two years, without re-making a joint, was taken out for examination. It was sectioned and the metal examined under the microscope; there was no sign of deterioration of the structure of the metal or of incipient cracks, and there was no corrosion. The replace pipe put in is still working under the same conditions.

Canadian Electrical Imports and Exports.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1926, are taken from the recently-issued trade statistics. Figures for the year 1924-25 are given for purposes of comparison, and notes of any increases or decreases have been added:—

Imports.

	1924-25.	1925-26.	Inc. or dec.
	$	$	$
Copper wire, plain, tinned, or plated—			
Total	71,000	120,000	+ 49,000
From United Kingdom ...	1,000	18,000	+ 17,000
,, United States	70,000	102,000	+ 32,000
Copper wire, covered, including cable—			
Total	341,000	495,000	+154,000
From United Kingdom ...	33,000	93,000	+ 60,000
,, United States	304,000	399,000	+ 95,000
Electric batteries, primary—			
Total (mainly from U.S.A.)	24,000	44,000	+ 20,000
Electric batteries, storage—			
Total	924,000	1,042,000	+118,000
From United Kingdom ...	334,000	464,000	+130,000
,, United States	590,000	577,000	− 13,000
Electric fans—			
Total	48,000	53,000	+ 5,000
From United States ...	47,000	50,000	+ 3,000
Electric fuses, fuse plugs, and cut-outs—			
Total (mainly from U.S.A.)	163,000	148,000	− 15,000
Lightning arresters, choke coils, &c.—			
Total (mainly from U.S.A.)	113,000	75,000	− 38,000
Rheostats, controllers, &c.—			
Total	299,000	324,000	+ 25,000
From United Kingdom ...	37,000	39,000	+ 2,000
,, United States	261,000	284,000	+ 23,000
Sockets, outlets, and receptacles—			
Total	144,000	180,000	+ 36,000
From United States	132,000	167,000	+ 35,000
,, Japan	8,000	12,000	+ 4,000
Spark plugs, magnetos, and other ignition apparatus—			
Total	441,000	681,000	+240,000
From United States	437,000	676,000	+239,000
,, United Kingdom ...	3,000	4,000	+ 1,000
Electric cooking and heating apparatus—			
Total	118,000	150,000	+ 32,000
From United Kingdom ...	1,000	12,000	+ 11,000
,, United States ...	117,000	132,000	+ 15,000
Dynamos and generators—			
Total	978,000	1,055,000	+ 77,000
From United Kingdom ...	74,000	176,000	+102,000
,, United States	810,000	827,000	+ 17,000
,, Sweden	77,000	51,000	− 26,000
Electric light fixtures—			
Total	546,000	586,000	+ 40,000
From United Kingdom ...	10,000	8,000	− 2,000
,, United States ...	505,000	549,000	+ 44,000
,, Germany	11,000	10,000	− 1,000
Electric meters—			
Total	210,000	281,000	+ 71,000
From United Kingdom ...	28,000	29,000	+ 1,000
,, United States ...	181,000	251,000	+ 70,000
Arc lamps—			
Total (mainly from U.S.A.)	24,000	39,000	+ 15,000
Incandescent lamps, carbon filament—			
Total	86,000	66,000	− 20,000
From United Kingdom ...	9,000	1,000	− 8,000
,, United States ...	13,000	17,000	+ 4,000
,, Germany	3,000	3,000	—
,, Japan	25,000	23,000	− 2,000
,, Holland	42,000	22,000	− 20,000
Incandescent lamps, metal filament—			
Total	301,000	419,000	+118,000
From United Kingdom ...	6,000	3,000	− 3,000
,, United States ...	80,000	84,000	+ 4,000
,, Belgium	10,000	10,000	—
,, Germany	18,000	20,000	+ 2,000
,, Japan	41,000	87,000	+ 46,000
,, Holland	136,000	213,000	+ 77,000
Self-contained lighting sets—			
Total	20,000	124,000	+104,000
From United Kingdom ...	4,500	12,500	+ 8,000
,, United States ...	16,000	112,000	+ 96,000
Electric motors—			
Total	1,816,000	2,239,000	+423,000
From United Kingdom ...	204,000	344,000	+140,000
,, United States ...	1,536,000	1,844,000	+308,000
,, Sweden	74,000	49,000	− 25,000
Switches, switchboards, circuit breakers, and parts—			
Total	949,000	1,145,000	+196,000
From United Kingdom ...	38,000	133,000	+ 95,000
,, United States ...	909,000	1,009,000	+100,000
Telegraph instruments—			
Total	155,000	105,000	− 50,000
From United Kingdom ...	11,000	11,000	—
,, United States ...	144,000	94,000	− 50,000
Telephone instruments—			
Total	303,000	502,000	+199,000
From United Kingdom ...	27,000	74,000	+ 47,000
,, United States ...	276,000	428,000	+152,000
Transformers—			
Total	295,000	217,000	− 78,000
From United Kingdom ...	5,000	9,000	+ 4,000
,, United States ...	261,000	202,000	− 59,000
Radio apparatus, n.o.e.—			
Total	2,500,000	3,464,000	+964,000
From United Kingdom ...	127,000	193,000	+ 66,000
,, United States ...	2,355,000	3,247,000	+892,000
,, Germany	8,000	9,000	+ 1,000
Electrical apparatus, n.o.e.—			
Total	3,833,000	3,078,000	−755,000
From United Kingdom ...	172,000	143,000	− 29,000
,, United States ...	3,511,000	2,889,000	−652,000

Exports.

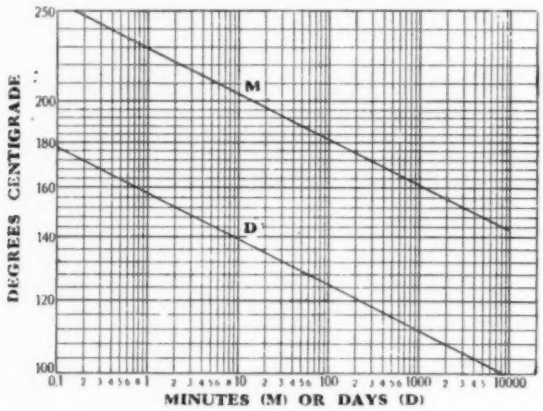
Batteries, telegraph and telephone apparatus—			
Total	314,000	391,000	+ 77,000
To United Kingdom	62,000	7,000	− 55,000
,, United States	18,000	35,000	+ 17,000
,, Newfoundland	37,000	13,000	− 24,000
,, Australia	4,000	34,000	+ 30,000
,, New Zealand	19,000	62,000	+ 43,000
,, Spain	7,000	8,000	+ 1,000
,, Sweden	5,000	14,000	+ 9,000
,, Cuba	68,000	73,000	+ 5,000
,, Brazil	27,000	51,000	+ 24,000
Dynamos, generators, and motors—			
Total	28,000	58,000	+ 30,000
To United Kingdom	4,000	16,000	+ 12,000
,, United States	11,000	34,000	+ 23,000
Electric cooking and heating devices—			
Total	181,000	343,000	+162,000
To United Kingdom	4,000	4,000	—
,, New Zealand	146,000	280,000	+134,000
,, Australia	21,000	25,000	+ 4,000
Spark plugs, magnetos, and other ignition apparatus—			
Total	289,000	277,000	− 12,000
To United Kingdom	99,000	34,000	− 65,000
,, Australia	73,000	107,000	+ 34,000
,, New Zealand	27,000	39,000	+ 12,000
,, British South Africa ...	16,000	20,000	+ 4,000
,, Straits Settlements ...	11,000	23,000	+ 12,000
Electrical apparatus, n.o.e.—			
Total	771,000	337,000	−434,000
To United Kingdom	47,000	48,000	+ 1,000
,, Australia	8,000	48,000	+ 40,000
,, New Zealand	24,000	36,000	+ 12,000
,, Newfoundland	327,000	43,000	−284,000
,, United States	34,000	29,000	− 5,000
,, France	—	6,000	+ 6,000
,, Japan	258,000	55,000	−203,000
,, Mexico	40,000	57,000	+ 17,000
Copper wire and cable, insulated—			
Total	584,000	380,000	−204,000
To United Kingdom	36,000	52,000	+ 16,000
,, United States	2,000	4,000	+ 2,000
,, Brazil	99,000	52,000	− 47,000
,, British South Africa ...	108,000	38,000	− 70,000
,, Newfoundland	44,000	24,000	− 20,000
,, New Zealand	64,000	78,000	+ 14,000
,, Cuba	126,000	69,000	− 57,000
,, Mexico	51,000	29,000	− 22,000

The total value of all electrical apparatus, including lamps and fixtures, imported into the Dominion rose from $12,110,000 in the fiscal year ended March, 1923, to $13,977,000 in the following 12 months, $14,289,000 in 1924-25, and $16,016,000 in 1925-26, whilst that of similar apparatus exported fell from $1,884,000 in 1923-24, to $1,582,000 in 1924-25, and $1,405,000 in 1925-26. These totals do not include wire and cable.

New Temperature Release Switches.

Three-phase Motor Protection by Temperature-rise Instead of Excess Current.

The usual form of overload protection provided for three-phase motors is of the electromagnetic pattern, which functions on a predetermined excess current being reached. It is, however, sometimes considered inadequate as a real means of protection for a multitude of practical cases because its operation does not take into consideration the temperature conditions obtaining in the motor. Thus, it may frequently be the case that a motor protected with the ordinary overload release would be unnecessarily disconnected from the power supply mains on heavy short-period overloads occurring which would not in any way harm the machine, because their duration would be insufficient to increase its temperature to such an extent as to cause damage. Prolonged overloads, on the other hand, shorten the life of motors; in fact, an overload of 30 per cent. maintained continuously for several days may



M = life of machine in minutes.
D = life of machine in days.

Fig. 1.—Relation between Temperature of Windings and Life of Machine.

lead to the complete destruction of the insulation. The relation between the life of a machine and the extent of overloads that can be applied can be clearly seen from the curves of fig. 1.*

Considering the case of a motor driving a machine tool, fig. 2 shows the relation between the load and temperature diagrams; it indicates that overloads of 42 per cent. lasting for some minutes during the space of a quarter of an hour, and commencing with a temperature of 53 deg. C., do not produce dangerous heating. This overload cycle can be repeated indefinitely without damage to the motor, provided an eight-minute pause is allowed between the cycles; without such a pause, however, the upper limit of the temperature

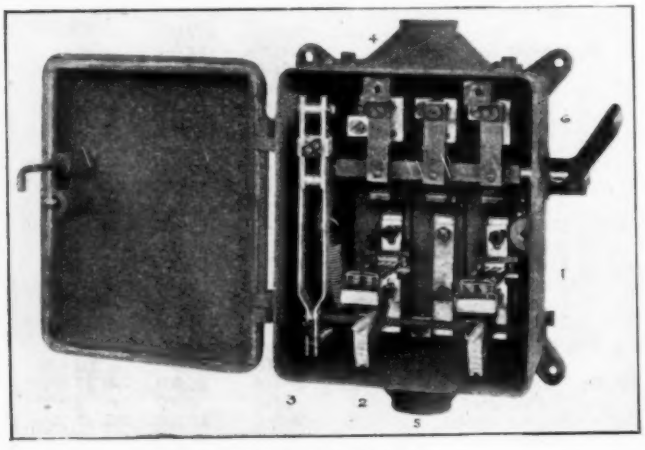
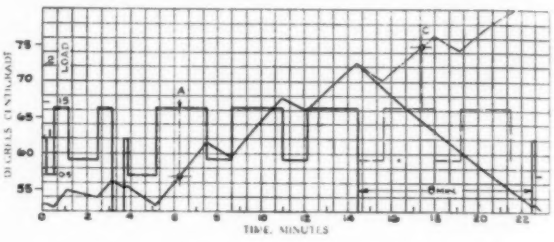


Fig. 4.—Interior of Switch.

would be reached within three minutes, as indicated by the chain-dotted curve. This case clearly makes it obvious that when an electromagnetic form of release is in use, damage would result to the motor if the human element was eliminated. The same thing can be said of nearly every motor installed, unless it is very amply rated, because some time during its life (perhaps often) conditions of sustained overload are unknowingly applied which result in damage, but which could be obviated if the right kind of protection was used.

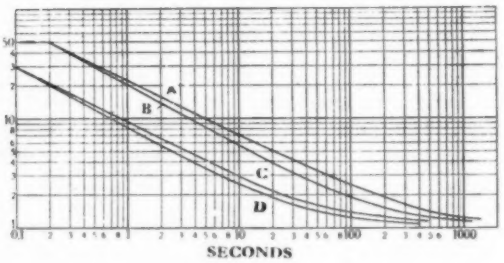
A switch has been developed and recently put on the market by the Brown-Boveri organisation which is claimed to fulfil the requirements, having the following salient characteristics:—



At A, with 1·4 times nominal current, an air-damped electromagnetic relay operates.
At C, on continuous service, as shown by chain-dotted line, the bi-metal strip would operate.

Fig. 2.—Service Diagram of Motor driving Machine-tool.

(1) The tripping arrangements disconnect all the poles of the motor in the event of a short-circuit taking place, or prolonged overload, when the windings reach the maximum permissible temperature; a prolonged inadmissible overload on one phase would operate the switch, and it will not disconnect when the overload is insufficient to damage the motor.



1 With temperature rise of 75 deg. C., A = temperature rise measured from 0 deg. C., and C = temperature rise measured from 60 deg. C.
2. For temperature release, B = temperature rise measured from 0 deg. C., and D = temperature rise measured in conjunction with continuous load with motor current. Ordinates = multiples of nominal current.

Fig. 3.—Excess Current and Time Curves for Motor and Release for Constant Releasing Temperature.

Fig. 5.—Switch and Ammeter.

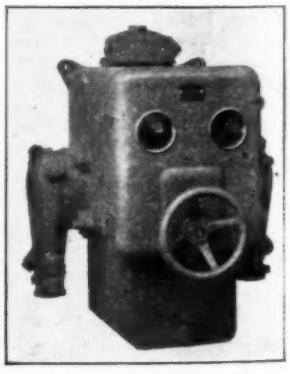


Fig. 6.—Oil-immersed Switch.

(2) Its construction is robust throughout—it is built to stand short-circuits; after operating, it is ready again for immediate service without any part having to be renewed.
(3) The releasing mechanism is so designed that it is suitable for mechanical tripping without the use of a releasing coil.
(4) The release can be adjusted to any desired current within the range of the temperature releasing elements in use.
(5) The switch is of simple construction and inexpensive.

* Steinmetz & Lamme, *Proceedings* of the American Institute of Electrical Engineers, 1913, page 115, and also H. M. Hobart, *General Electric Review*, 1917, page 291.

The releasing elements in the switch consist of insulated laminations of metallic strips, the materials being so chosen that considerable curvature is obtained as the current increases. Consequently, the force exerted is quite appreciable and adequate to operate the tripping mechanism, which has been so constructed that the release is simply and definitely performed without friction. The metallic strips operate directly on the trip and thereby, it is said, eliminate all possibility of failure to function.

The design of modern electric motors of whatever make has been so standardised that all, more or less, have the same heating characteristics. This fact has enabled the switch to be so accurately designed that the operation of the releasing elements very closely follows the heating conditions met with in practice. The curves in fig. 3 clearly show this; here is given the permissible overload capacity of a three-phase motor for periods up to 1,000 seconds, and the corresponding curves for the temperature release: Curves (*a*) and (*b*) refer to cold starting, and (*c*) and (*d*) starting at 60 deg. C., which, in the case of the curves in question, is assumed to be the temperature rise of the motor after a normal continuous run at full load.

The interior construction of the switch can be seen from fig. 4; 1 is the temperature release, 2 the device for adjusting the amount of the releasing current, 3 the release catch, 4 the terminals for the mains, 5 the motor terminals, and 6 and 7 the contacts. An insulated partition is placed in front of the contacts, thus forming a spark chamber. Fig. 5 is an outside view of the switch with an ammeter mounted thereon. The switch door is automatically locked when the supply is on, so that it cannot be inadvertently opened in such circumstances.

The switch is manufactured in two sizes, one for pressures up to 660 volts and currents up to 125 amperes with air-break contacts, the other being of the oil-immersed pattern for pressures up to 6,400 volts and currents to 400 amperes; the latter switch is shown in fig. 6. The temperature releasing elements are made for 10 different normal ratings, so that the switches are suitable for any size of motor up to the maximum rating for which the elements are provided.

The following main advantages are claimed to result from the use of these switches:—(1) The protected machine is disconnected before damage occurs to it, and the power supply is not unnecessarily interrupted, for the temperature of the motor must first reach the admissible limit; the switch can be closed again immediately after it has opened, while it is capable of standing whatever short-circuits are likely to occur in a properly dimensioned circuit. (2) The switch is simple in design and operation; squirrel-cage motors can be started with it on load, *i.e.*, the temperature release device has not to be short-circuited.

We are indebted to British Brown-Boveri, Limited, for the details and diagrams upon which the above notes are based.

A 100,000-Ampere Electric Furnace.

Some Particulars of a Single-electrode Furnace installed in France.

One of the disadvantages of electric furnaces for the manufacture of carbide and ferro-alloys is their high consumption of energy. Hence it is not surprising that with rising costs electrometallurgists are sparing no efforts in their endeavours to increase the efficiency of such furnaces. One solution that has been discovered as a result of practical tests is that economy can be effected by the use of larger furnaces. Thus in the manufacture of carbide it has been shown that in a furnace of several thousand kilowatts capacity a ton of material can be produced with a consumption of less than 3,500 kWh, as against from 4,000 to 4,500 kWh required for a 500-kW furnace. Another direction in which improvement is being sought is that of a reduction in the number of electrodes, and in this connection the particulars of a 100,000-amp. single-electrode furnace which has been installed at the works of the Société Electrométallurgique de Montricher at St. Julien-de-Maurienne, France, and described in a recent paper by Prof. Paul Bergeon, of the Electrotechnical Institute of Grenoble, are of interest.

The furnace was designed by M. Paul Miguet, the manager of the Electrométallurgique Co., who had many difficulties

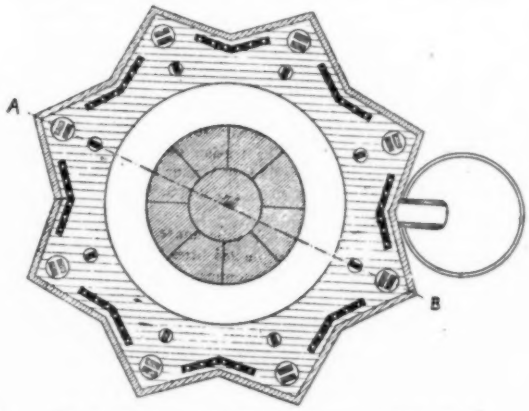


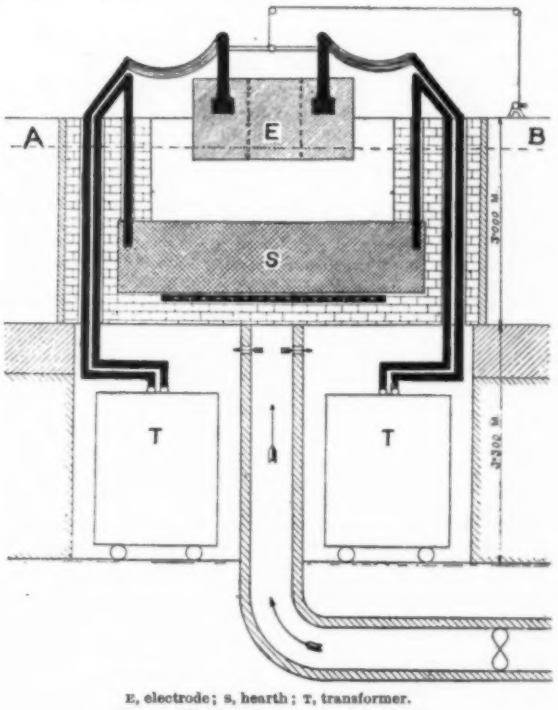
Fig. 1.—Horizontal Section of Furnace, at A B, fig. 2.

to overcome owing to the large diameter required for the electrode and the need for arrangements to secure a high-power factor, notwithstanding the great intensity of the current and the 50-cycle frequency.

The electrode of the furnace is no less than 7 ft. 6 in. in diameter, and 1.2 m., or practically 4 ft., in height. It is built up of eight sections of carbon, each supported by a current terminal and assembled together by a carbon ramming which forms at the same time the central portion of the electrode. The current admission terminals are of cast steel sealed with copper; they are hollow and provided with water circulation. The various current terminal pillars are bolted to a central steel piece suspended from a cable, which is wound on an electric winch controlled by an automatic current-intensity regulator.

In order to lower the reactance of the furnace M. Miguet at first endeavoured to reduce to the minimum the loop formed by the non-sandwiched conductors, the electrodes, and the mixture in the furnace. With this object he experimented in the direction of passing into the interior of the furnace, in the refractory bricks, as near as possible to the electrode, leads conveying current to the conducting hearth, the leads being of bronze, kept cool by means of a circulation of water. It was not found possible, however, to obtain a high power factor in this way, experience showing that to overcome the effects of self-induction the current must be divided up over a number of circuits, that is to say, by conveying the current to the electrode and to the hearth by several groups of conductors well separated one from the other, each group passing not more than 15,000 amperes.

Prof. Bergeon has worked out the following empirical formula for calculating the power factor of an electric furnace,



E, electrode; S, hearth; T, transformer.

Fig. 2.—Vertical Section on A B, fig. 1.

in which no regard is had to the size of the conductors or the form of the loop, namely, $\sin a = 3\pi l f 10^{-6}/nU$, in which l represents the length in metres of the loop, *i.e.*, the length of the non-sandwiched conductors to the electrodes, and of the current path in the electrodes and in the material under treatment, the self-inductance of the sandwiched conductors being regarded as practically negligible; I the current absorbed by the furnace; f the frequency; n the number of separate circuits connected up to the electrodes, and U the pressure in volts at the secondary terminals of the transformers.

In M. Miguet's furnace, which has an inside diameter of 11 ft. 6 in., the loop is a relatively short one, amounting to only 26 ft., and comprising eight separate circuits, one for each section of the electrodes. The conductors are equally spaced and radiate to the electrode and hearth. The arrangement is in fact such that instead of having a single furnace taking 100,000 amps., there are eight 12,500-A furnaces combined in a common chamber.

Applying the formula set out above, it will be found that with a frequency of 50 cycles and a current of 100,000 amps. at 50 V the power factor works out at 0.953, with which the results obtained in practice (0.949) have been found to agree very closely. At the primary of the four transformers which supply current to the furnace the power factor is lowered to 0.930 owing chiefly to transformer leakage and magnetising current.

The Miguet 100,000-A furnace is interesting also from the point of view of its construction. It is made of ferro-concrete and perfectly air and liquid tight, although as a precautionary measure a lead sheathing is provided, to ensure that no air can penetrate the hearth and so injure the furnace. In plan the furnace takes the form of a star-shaped polygon; at each of the star points is a chimney or hole serving as a passage for the sandwiched conductors from the transformers. The primaries of the latter are connected up to a 5,500-V single-phase line and the secondaries are connected in parallel to the furnace and the electrode hearth. Furthermore, the transformers are below the furnace in order to give a clear space round the latter and to render the eight circuits symmetrical.

The cooling of the furnace is effected laterally and below the hearth by means of cast-iron plates between which are coils for the circulation of water. The central ferro-concrete pillar which supports the whole of the furnace is also made hollow and utilised to form a passage for air impelled through it by means of a fan, which air is ejected through the conductor holes, thus keeping cool both the conductors and the bricks surrounding them.

The furnace was put into operation in July, 1924, and has since been continuously employed on the production of carbide, ferro-manganese, and ferro-silicon, the voltage for carbide being 54-57 volts, for ferro-manganese 39-40 V, and for 55 V and 50 V for 25 and 45 per cent. ferro-silicon respectively. Tests carried out with the furnace, which is stated to be the largest one with a single electrode in the world, show that the average consumption of energy per ton of carbide or alloy is 3,250 kWh; it will easily take up to 5,000 kW, and withstand a current up to 120,000 A.

Long *versus* Short Radio Waves.

The New Season's First Discussion before the Radio Society of Great Britain.

The subject considered at the opening meeting of the 1926-27 session of the Radio Society of Great Britain was "The Relative Values of Long and Short Waves."

Sir Oliver Lodge, president of the Society, in a communication regretting his inability to attend, is reported to have expressed the opinion that shortness of wave might not be an advantage for transmission purposes, though high radiating power was; various wave-lengths might be found suitable for use at different times of the day.

Dr. W. H. Eccles initiated the debate by remarking, *inter alia*, that five years ago the use of short waves for long-distance communication began to attract the enthusiastic attention of amateur investigators. The first amateur trans-Atlantic tests of February, 1921, and those of the following winter were conducted with waves of 200 metres length, or less; at the end of 1922 the Pittsburgh broadcasting station (KDKA) was transmitting on a wave-length of between 90 and 100 metres, but before that date the general experience of short waves was that they were only really useful for short distances; and when they did traverse long distances the performance was known as freak transmission. During 1923 waves shorter than 150 metres became more common as commercial firms and amateurs took up their study in increasing numbers.

They had now had 20 years' experience of long waves and four years of short waves in long-distance radio-telegraphy. In the case of very long waves, say, over 15,000 metres, the facts were relatively simple: such waves travelled almost equally well by day and night, and the distance to which good signals could be transmitted depended merely on the power employed, but waves of medium length, say, 1,000 metres, were different, for they travelled much better by night than by day. In both cases the strength of the signals fell off steadily as distance increased, at any rate, after the first few hundred miles, and so a thousand kilowatts power was needed to send signals to the Antipodes for 24 hours in the day. As a broad rule the number of hours of service could always be increased by increasing the horse-power.

Their four years' experience of short waves, that was, waves shorter than 200 metres, had been crystallised in the recent writings of a number of technical men, chief among whom might be mentioned Hoyt Taylor (of the American Navy), and Heising, Schelleng, and Southworth (of the Bell Telephone Co., of New York). Taylor had classified the reports which hundreds of amateurs sent to him about his station; his results with a power of five kilowatts might be summarised as follows: In the daytime a wave 100 metres long could be picked up so far as 200 miles away; a wave 50 metres long, at 100 miles; a wave 30 metres long could be picked up at all distances up to 50 miles, but was often inaudible at points between 50 and 500 miles, yet was readable again at all distances between 500 and 1,500 miles. The space over which signals were inaudible formed a circular silent zone over which the signals jumped; it was called the "skip." Shorter waves had a longer skip; for instance, 15-metre waves ceased to be audible at 10 miles, skipped 1,500 miles, and were then audible with some uncertainty up to 3,000 miles. All the above data related to daylight transmission.

At night time in winter 100-metre waves with 5 kilowatts output had been heard at all distances up to 8,000 miles; 50-metre waves up to 10,000 miles, while 40-metre waves skipped 500 miles and went to all distances beyond; 30-metre waves skipped 4,000 miles, 20-metre waves skipped 7,000 miles, and both could be heard at all distances beyond; but the 15-metre wave, after travelling a few miles, skipped off the earth for good. Similar things happened in summer nights, but the skip was less marked.

The work of Heising, Schelleng, and Southworth had consisted of actual measurement of strength at various distances; they found that the strength varied from season to season, from hour to hour, and even from second to second. In the daytime the strength of all waves between 111 metres and 16½ metres fell off with increasing distance as fast as, or faster, than that of long waves, but at night time short waves of 111 metres and 66 metres travelled much better. What happened to still shorter waves at night was complicated by the skip, but, as a broad rule, after the skip the signals became stronger the farther they went—an amazing conclusion. It was to be noted, however, that there was usually a time in the middle of the night, say, from midnight to 3 a.m., for waves of 33 metres and distances of 1,000 miles, when the signals would not get through. Remembering that midnight occurred at different instants at different places on the globe, it would be appreciated that the reception of such signals at distances of thousands of miles was complicated very greatly by their midnight vagaries.

The writers of the very valuable paper referred to laid stress on the instability produced by those various conditions; they had made special observations on fading and found that the rate of fading might be very slow, or as quick as one hundred times a second. Sometimes one wave faded, while another of slightly different length increased in strength. Some of those phenomena occasionally made radio-telephony impossible, because of distortion. Nevertheless, very useful service could be rendered in both telegraphy and telephony by short waves, but it was important to choose the wave-lengths carefully for any given task and to suit the hour of day and other conditions. For telephony to 200 miles distance one could use 100 metres; for 500 miles, 50 metres, and then it might be possible to maintain almost a 24-hours service. For a thousand miles one could use 30 metres in the day and about 60 m. at night; for trans-Atlantic work the wave-length should be altered between 100 and 20 metres from time to time in order to maintain reasonably continuous touch.

From the whole mass of scientific observations now available in the technical literature of the subject, Dr. Eccles concluded that short waves were certainly more useful than long waves from stations of equal power for distances up to 1,000 miles. Beyond that distance the relative utility of short and long waves depended upon the kind of work to be done and the time when it was done. Amateur investigators would always find short waves vastly more interesting and much cheaper to employ than the long waves for the purpose of international communication. For commercial purposes, countries that needed to be in touch with one another for only a few hours daily would also adopt short waves. On the other hand, a commercial firm which was running a long-distance service in competition with cables would find long waves more trustworthy. In such a service it was often necessary to ensure the delivery of messages within a very limited time of their being handed in: in that case long waves were best during certain hours of the day and would be used even though the plant was more costly; but there was the possibility that in the course of time methods of changing from one short wave to another exactly as atmospheric variations demanded might be developed, and such a development would put the short wave on a level with the long wave, but might, of course, at the same time, make the short-wave plant as costly as the long-wave plant.

The Electricity Supply Congress at Rome.

(By Our Special Correspondent.)

(*Concluded from page 561.*)

Communication Systems.

A PAPER of interest drawn up by M. R. Dubois was presented for discussion, on "Telecommunications between Generating Stations and Sub-Stations in Connection with Large Transmission and Distribution Lines." The paper, like the other papers usually presented to this Society, is very practical in character, giving the results of inquiries sent out to numerous large undertakings in France as to the means taken to ensure the proper technical management and operation of large systems. It is written in French and well illustrated.

M. Brylinsky, the general reporter for this section of the Congress activities, in his introductory remarks, points out that the problem is in the stage of evolution, and that while certain desiderata are of a financial nature, they are none the less important for that reason, as the means necessary for obtaining security should not become a crushing burden on distributors of energy. Further, the technical side presents some real difficulties which are gradually being got over. The following is a summary of the paper:—

Those undertaking electricity supply require some means by which orders or information can be transmitted from point to point. At the present time the multiplicity of lines and the extensions of the applications of electricity make the use of some system of telecommunication an absolute necessity; such a system is required not merely by law, but to give security to employés and material, and confidence to employés and to customers, this last a matter of importance in view of the heavy penalties payable in many cases in the event of failure of supply.

The following are the principal requirements:—

(*a*) Absolute reliability in operation.

(*b*) Absolute security (from h.p. current dangers) for the *personnel*.

(*c*) Great rapidity of exchange operation.

(*d*) Minimum establishment and maintenance costs.

No one system covers all these requirements, and many authorities employ alternative means where important points are concerned. Large organisations to-day are more and more employing telecommunication services placed directly under the control of technical directors; this is a desirable tendency, as it is undeniable that such services can only be efficiently directed by specialists, and the cost of competent supervision is balanced by the value received. Another arrangement which has desirable features is to place such service in the hands of a firm that specialises in the maintenance of telecommunication. The State in France has recognised the necessity for internal communications for electricity suppliers, but has made annual charges (for licences, &c.), which are found to be prohibitive; in some cases of small lines the charge made per year exceeds the net profit received from the sale of energy, the supply authority, in such cases, having not merely to assure the supply of energy, but also to keep its own telegraphic communications intact. A service of telecommunication is as important as a service of automobiles; there is one supply authority (in France) that spends half a million francs on its internal telephone service and a similar amount on its automobile service annually.

The following are different methods of communication:—

1. Connection to the normal postal telephone system.
2. Telephone lines on supports separate from those carrying h.p. lines.
3. Lines on h.p. supports.
4. The use of high-frequency systems.
5. Wireless-telephony.

The methods under 2, 3, and 4 can be telephonic, telegraphic, or mixed in character, and may also be systems using the power lines themselves, using special lines, or not using any lines.

The advantage of using a telegraphic system is that with it a recording apparatus can be used, and the record can be filed for reference, and thus exact details of orders, &c., given and the time and dates can be retained, a matter at times of great value. It is not as fast as a telephone, but by combining both means it is possible to send instructions rapidly or to send a message the details of which it is desirable to record.

To use the State system is not satisfactory; an electricity authority should be master of its own communications, and should not have to rely on the service of others not in its own employ. It is important, however, to make arrangements so that each point served should be connected also to the State telephonic system; it is useful for repair gangs and also regarding complaints from customers; the State system should not be used as the sole system.

Telephone lines on routes separated from power line routes are at present the system most used in France. (It is also used to a material extent in Italy.) The State in France reserves the right to construct these lines on its own posts or on separate routes. Generally existing routes can be used; in other cases the Telephone Administration decides on the route, reducing, as far as possible, the number of road, railroad, canal, and power line crossings, &c., a charge for construction being made according to the difficulties of the route.

At present the cost of establishing a line on French Post Office poles, for a length of 50 km., is about 2,500 fr. per km., and on separate posts 5,000 fr. per km., with an annual charge of 504 and 714 fr. per year; for longer distances the charges are reduced.

For sub-stations, wall telephones are desirable; for line testing the "Seibe" type is very useful. Gardy and Bertsch lightning arresters and fuses are used in most cases; difficulties sometimes occur through failure of the postal servants to replace melted fuses. For series working the magnetos should be strong; in such cases the number of rings is used to separate the calls; sometimes auto-calling systems are used.

The metallic-line system on a separate route is vulnerable to storms, but not materially affected by power-line surges, where the line is kept well away from a power line. The system does not allow of direct communication with a power-line repair gang, which leads to a waste of time and reduction of security to the *personnel*. A number of supply authorities complain of tree-branch troubles and the necessity for the supply authority's own gang to be sent out to clear them in cases of urgency. The communications on this system are usually good.

Electricity Supply Laws and Electrical Progress.

Signor CIVITA, Director of the Italian Association of Electricity Companies, in his General Report on Electricity Supply Law, given at Rome on September 24th, which covered special reports regarding six European countries and particulars collected from five other countries, pointed out that the laws of Italy were unique in their extreme liberalism. Almost all the development which had taken place was the result of private enterprise. There was no monopoly given, up to the time when certain Government subventions were granted, there was no question regarding the limitation of tariffs, and, apart from certain rules and procedure regarding appeals to tribunals for the settlement of compensation in respect of rights of way, there were no concessions at all. As a result of this policy a remarkable system of interchange mains had been built up which would shortly reach from end to end of the Italian peninsula, and would enable the Alpine, Central and Southern water power installations to be used to the limits of their capacity. The State had a right to take over hydraulic installations proper after a term of years, but apart from private treaty no legal right to take over distributing or transmission mains or systems at all.

M. BRYLINSKY, of Paris, said that the legislation in his country appeared to be hard, but it was being developed with the whole-hearted co-operation of those responsible for power production in France. The laws were not unfair as far as their application was concerned, and concessions had been given for a duration up to 75 or 80 years. The view of the meeting seemed to be that excessive Government or local interference tended to keep back electricity supply.

During the discussion, Signor Civita pointed out that as the result of the extremely liberal policy adopted in Italy, although it was a small and comparatively poor country, such was the confidence of the public that four milliards of lire had been invested in electricity supply.

Official Receptions.

The Italian Finance Minister, Count Volpi, representing the Premier, Signor Mussolini, received on Friday, September 24th, a number of participants in the Congress of Electricity Producers. Count Volpi before joining the Ministry was one of the electrical pioneers of Italy, being largely responsible for the development of the Adriatic Electric Company's area; he had also been very successful in the difficult position of Governor of Tripoli. He said that in order to develop home industry, his Government was giving a subsidy of 40 to 60 lire per hydraulic horse-power for 15 years in the North of Italy, and on a higher basis in the South. This was equivalent to 20 or 25 per cent. of the cost of construction. As the State had put up so much money it should have some say in electrical matters.

On September 25th, Signor Mussolini received, in the evening, a number of members of the Congress; they were presented by Professor Ponti, President of the Union Internationale. Signor Mussolini, who was received with acclamation, in acknowledging their greeting, said that of all the liberal professions he preferred that of the engineer, because it was the nearest to his ideals. If he had to make a preference among engineers, he would prefer those connected with electricity. He asked them when they went home to relate what they had seen, a people working under difficult conditions which could not afford to waste a minute of time.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Coloured Composition Lampholders.

In the description of Messrs. Ward & Goldstone's works at Manchester, in the Electrical Review of October 9th, 1925, we referred to the manufacture of the black composition moulded Home Office patent lampholders which the firm had then commenced. It is interesting to learn that these holders are now being made in a white ivory (Ivorant) finish, intended for use in such places as bathrooms. We have received a selection of these mouldings from Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester. They are produced in a variety of colours, to harmonise with colour schemes, including one of an imitation marble pattern.

New Miniature Instruments.

A "miniature series" of d.c. instruments has been introduced by Messrs. Elliott Brothers (London), Ltd., in association with Messrs. Siemens Brothers & Co., Ltd., of Woolwich, for accurate measurements in all instances where a relatively small instrument is needed. They are high-class instruments, designed and constructed on the lines of the makers' larger models, and are made in several patterns, of the round and sector types.

The instruments are of the moving-coil type, the moving coil being wound on a seamless aluminium former and controlled by well-aged non-magnetic springs. The pivots work in highly polished sapphire jewels, and the complete moving system is extremely light and rigid. The instruments are said to be extremely dead-beat and quick in action, with a long, useful life. All parts are interchangeable. The scales are individually calibrated and are evenly divided throughout the range. The larger sector-pattern instruments have a degree of accuracy in accordance with British Standard Specification No. 89 for first-grade instruments, and the smaller instruments approximate closely to first-grade accuracy.

A large number of standard ranges is listed. The standard finish on all instruments is dull black enamel. Fig. 1 shows an ammeter of the sector pattern, having a scale over 4 in. long.

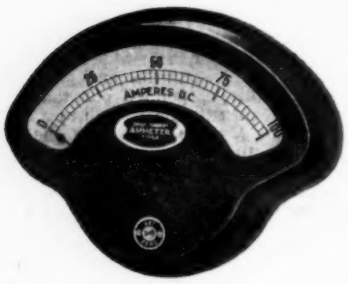


Fig. 1.—Elliott Miniature Ammeter.

The Zipp Electrician's Life-Saver.

Despite the many warnings, accidents are still recorded among electrical workers owing to contact with mains, terminals, &c., which, contrary to anticipation, are "live." Already there are many instruments on the market for indicating that conductors are "live," but considering that the majority of these are too expensive for general use, a German company has recently put on the market an instrument known as a "life-saver," devised and patented by Prof. Zipp. It consists mainly of a neon-filled luminous tube and a high-pressure condenser in series, the condenser serving as a means of earthing the tube and to allow the current to light up the tube if the conductor to which it is applied is "live." Thus to test a conductor it is only necessary to apply one end of the life-saver to it and connect the other to earth. The neon tube is enclosed within a glass tube, the latter being itself protected when not in use by an insulated holder. An opening is provided in the glass tube, and the device is connected by a hook to the electrical line. A condenser is also located within the insulated holder. One of its poles is connected to the holder, while the other is attached to the metal end cap, which is provided with a terminal for the attachment of the earthing wire. Finally, a hollow wooden handle, which, when the device is not in use, acts as a protecting cover, is screwed on to the condenser end of the apparatus. The whole device is of a size that can be included in any electrician's tool kit; the instrument for voltages up to 5,000 is less than 2 in. in diameter and about 12 in. in length. For each additional 5,000 volts an extra condenser element is used, increasing the length by about 3-in.

The voltage indicated in the tube is the difference between phase (the connecting hook) and earth; full illumination occurs at about one-fifth of the full voltage, but even on a 20,000-V line the neon tube glows visibly at 1,000 V. It is intended that electricians should use the life-saver before commencing on any strange job in order to ensure that no current is passing. It may also be used in tracing short circuits and current leakages, these being shown by the varying resulting glow in the neon tube when it is applied to different sections of a circuit.

A New Portable Recorder.

The portable recorder illustrated in fig. 2 is a rather remarkable instrument recently designed by Messrs. Eversheds and Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4, to meet a special requirement. A number of recorders have been made in the past to show the positions of switches at distant stations or to record the operation of machines. A request was received some time ago for a portable recorder which should combine a recording ammeter with 20 movements of the type just mentioned, to show whether switches at a distant sub-station were "On" or "Off." As 20 operation records had to be packed into a space 6 in. wide, the problems of design were very severe. The difficulty of having so many movements close together was solved in a neat manner by having two banks of movements; this is shown clearly in the illustration. The pens are so arranged that it is impossible for any fouling to take place. We understand that the recorder has been quite successful, and in addition to the instrument made to the order of the Metropolitan-Vickers Electrical Co., Ltd., to be supplied to the Bombay, Baroda and Central India Railway Co., other instruments of a similar character have been supplied to the same company for shipment to the Far East.

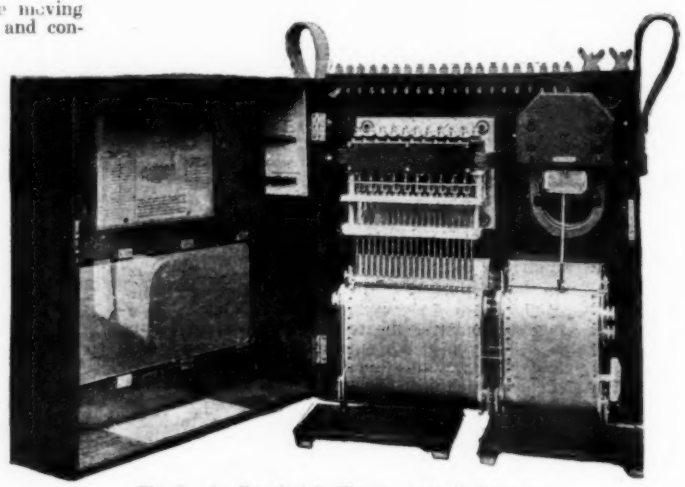


Fig. 2.—An Eversheds & Vignoles Portable Recorder.

This instrument is illustrated in the new Recorder Catalogue No. D113, which has recently been issued by Messrs. Eversheds & Vignoles, Ltd.

The "Atalanta" Screwdriver.

We have received from Atalanta, Ltd., 1-3, Brixton Road, S.W.9 (an engineering company run entirely by women), samples of a handy screwdriver which is being produced by the company. The chief feature of the appliance is a loose top which is held while the screwdriver is rotated by means of a knurled flange further down the spindle. While we believe that this idea is not new, having already been applied to watchmakers' screwdrivers, we do not remember having seen it used for larger screwdrivers. Another good point about the "Atalanta" is the length of the shaft, which makes it convenient for use in awkward places. The device is made in three patterns. A small "wireless" type; a "mechanic's" model which has a mild steel handle and a best-quality cast steel blade; and an "electrician's" model, illustrated in fig. 3, which has a handle of vulcanised fibre and a cast-steel blade of smaller dimensions.

Fig. 3.—The "Atalanta" Electrician's Screwdriver.

The Electrification of Suburban Railways.

By R. H. SELBIE, C.B.E.

(*Abstract of Presidential Address to the* Institute of Transport.)

There is probably no department of our national life in which greater advances have been made during the last half-century than in the department of transport. It has become an axiom in transport circles that "facilities create travel," and certain it is that the travel-habit amongst the people of this country has increased enormously as a result of the larger opportunities offered. Taking Greater London as an example, the official statistics show that the journeys made per head of population have increased from 188 in 1905 to 456 in 1925. The science of transport is now recognised as a factor of first importance in our national economy. I propose to deal in this address mainly with one branch of railway business which is engaging a good deal of public attention at the present time—electrification in general, and particularly the electrification of suburban lines. It may properly be claimed that electricity has been the most potent factor in the advancement of transport by railway during the last 30 years. Without it the "tube" system of London, which is probably the most complete and efficient in the world, would have been impossible.

The tendency for people to live at a distance from their places of work is a growing one. The demand thus created is leading to the provision of housing accommodation on a large scale in areas lying between ten and twenty miles from the Metropolis and other large commercial centres which hitherto have been inaccessible to the daily worker. These things point to the necessity for the establishment of a fast and frequent means of transport between our great cities and industrial areas and the outlying residential districts. In this connection, the railway companies, with some notable exceptions, have not displayed the same foresight and enterprise that have characterised their policy in regard to long-distance traffic. There has been a leaning in some railway quarters to the view that local and suburban traffic, especially in connection with provincial centres, was best left to the roads, where the means of transport by electric tramcars, motor-omnibuses, &c., were constantly being increased. This view is quite an erroneous one. 'Bus and tram transportation is not sufficiently convenient or comfortable. So long as railway companies continue to deal with their local traffic by the old methods and the means of transit by road improve, there will necessarily be a transfer of business from the one to the other, especially of the shorter-distance traffic, but the public requirements will not be adequately met. I am of opinion that within a comparatively few years the use of the steam locomotive for dealing with purely local and suburban traffic on our railways will be as much out-of-date as a horse 'bus or a steam tram. In the case of London, the distances to be covered before the outlying country is reached are greater than in the case of most provincial cities and, therefore, the need for quick methods of transport is more pronounced, but the necessity for bringing the country areas around our large industrial centres within easy reach of the workers in those centres is just as urgent and the demand for the facilities is becoming just as great. In this connection it must not be overlooked that there is a limit to the carrying capacity of our roads. The number of motor vehicles of all kinds is increasing at an alarming rate, and at certain times of the day the consequent congestion is such that progress is slow and the regulation of traffic difficult. This must inevitably have the effect in a short time of driving people in greater numbers to the railways, upon which the facilities will have to be increased to meet the demand. The most practicable and economical way of accomplishing this is by electrifying the existing steam lines serving the outlying suburbs of our large centres of population in the way that has already been done with such marked success in some instances.

It must be remembered that, in the case of local and suburban travel, speed is just as important a factor as in the case of longer-distance journeys; when we reflect that a man living eight miles from his place of employment travels some 5,000 miles in the year, occupying at least 300 hours, it will be seen that the rate of travel plays no unimportant part in the economy of his time. For daily journeys covering a distance of this kind motor-'buses and electric trams need not be regarded as effective competitors of railways; experience has shown that the dividing line comes at about the third milestone. The advantages of an electric rail service will often turn the scale against the road journey, while a steam service would not do so.

The benefits accruing to the travelling public from the electrification of a suburban line arise from advantages that are inherent in that system of working as compared with steam operation, such as greater speed, more frequent services, greater cleanliness and comfort. In 1903 the New York State Legislature enacted that after five years from that time steam locomotives would no longer be allowed south of the Harlem River and that the several railway companies operating in and out of the city must, within the prescribed time, provide themselves with such electrical equipment as might be necessary to enable them to comply with the requirement. This was done, and consequently the practice to-day on all the main lines of railway radiating from New York City is for an exchange from steam to electric locomotives and *vice versa* at the nearest convenient point to the prescribed limit. Thus the great terminal stations of New York are far more clean, comfortable and inviting than those of our own Metropolis.

The system of railway electrification generally adopted in this country, *viz.*, the direct-current, third-rail system, has proved itself so far to be the most satisfactory and economical for the operation of suburban and interurban lines. The difficulties forecast by the opponents of the system at the time of its introduction have not materialised.

The question of terminal platform accommodation is one that is closely linked up with that of the electrification of suburban lines. Assuming a case in which the maximum service of local steam trains into and out of a city terminus has been reached and where the growth of traffic and other considerations demand that a greater number of trains be run, there are two courses open, by means of which the necessary end can be accomplished still under steam conditions, each involving a large expenditure of capital. First, the signalling sections on the local lines can be shortened and a system of automatic signalling introduced. This will admit of a small addition to the number of trains run per hour, but the difficulties of terminal accommodation will be enhanced. The other expedient is the doubling of the line and the provision of more platforms and platform roads. In many cases, probably in the majority of cases throughout the country, this latter alternative is physically impossible in consequence of the terminal stations and the approaching lines being hemmed in by important thoroughfares which could neither be closed nor diverted. And even in cases where there is room for expansion, the cost would generally be prohibitive owing to the high value of land and property in the vicinity of such stations. The problem to be solved, therefore, is how to increase the train-carrying capacity of a line without widening it and in a way that will not involve the enlargement of the terminal station. The solution is to be found in the substitution of electric for steam motive power.

By the use of electric trains on the multiple-unit principle, *i.e.*, with motors and driving apparatus at each end, the shunting of engines is obviated and the operation of platform roads is materially reduced. This is equivalent to an increase in the terminal accommodation, without the necessity for any structural alterations.

In the case of motor-operated trains, the power can be so applied and the gearing so arranged as to render possible a much quicker acceleration of the trains. Recent experiments made with trains of an equal weight hauled in the one case by modern motors, and in the other by an up-to-date steam tank engine of the type usually employed in local services, reveal the fact that an electric train starting from rest will attain a speed of 30 miles per hour in 25 seconds, while it takes the steam-hauled train 60 seconds to attain the same speed. In general, the average increase in speed of an electric train during accelerating periods is, according to recent tests, 1.19 miles per hour in every second, while that of a steam train doing the same work is only 0.5 mile per hour in every second. The maximum speed of a modern electric motor-car is about 65 miles per hour, while electric locomotives are designed for still higher speeds, so that in this respect there is little difference between steam and electric working. The advantages derived from the higher acceleration under electrical conditions are obvious, the most important being the greater number of trains it is possible to pass over the line in a given time. Another important result following from increased acceleration is the possibility of securing the full benefit to be derived from a shortening of the signalling sections and of the installing of automatic signalling. The train-carrying capacity of the line, and consequently its earning power, are thus greatly enhanced.

A third advantage that an electrically-worked train has over a steam train lies in its greater flexibility, or, in other words, in the readiness with which its composition can be adapted to the varying needs of the traffic. In the case of suburban lines, with which we are dealing, the traffic between 10 o'clock in the morning and 4 o'clock in the afternoon and after 8 o'clock in the evening is light compared with the traffic during the business hours, and it is the practice on electrically-worked lines to reduce the number of cars per train during the slack hours by one-half or even more. It is possible thus to maintain a frequent service of short trains at a lower traction cost almost proportionate to the reduction in the number of coaches. This cannot be done with the same facility under steam conditions, because, apart from the shunting difficulties attendant on dividing a train, the locomotive cost is not reduced in anything like the same ratio as the reduction in the number of coaches hauled.

Turning now to the question of the cost of equipping a section of ordinary steam railway for electrical working, recent experience enables me to quote some exact figures. Before doing so however, I think it right to say that on this point it is not entirely safe to generalise. Local circumstances vary considerably, and while the figures I am about to give may be taken as applicable to any suburban main line used by passenger and goods trains, the largely-increased service rendered possible by the electrification will almost inevitably necessitate a revision of the signalling arrangements, and there will no

doubt be cases in which, for the same reason, it will be desirable to substitute fly-over or fly-under junctions for the flat junctions that hitherto have been sufficient for the less intensive service under steam conditions. Subject to these qualifications, the cost at to-day's prices of electrifying a section of, say, ten miles of standard railway, including positive and negative conductor rails, with the necessary copper bonding, the provision of high- and low-tension cables and two sub-stations equipped with the necessary rotary converters, amounts to not more than £22,500 per mile of double track, and the cost of track-circuiting and semi-automatic signalling, which, as already stated, will almost certainly be necessary, amounts to another £2,500 per mile, making a total cost of £25,000 per mile of double track. These figures hold good whether the high-tension current be purchased from some general power station in the neighbourhood or supplied from the railway company's existing generating plant. The costs I have quoted represent the whole of the capital outlay a railway company need incur to enable it to reap the advantages accruing from the electrification of its suburban lines. Twenty years ago, it would have been necessary for the company to lay out a further large sum in erecting and equipping a generating station with all its numerous adjuncts, but to-day high-tension current can be purchased at reasonable rates for consumption in almost any part of Greater London, and the facilities in this direction are increasing all the time. In the matter of rolling stock, again no capital expenditure need be incurred on electrification. Every railway company spends a certain amount of money annually out of its renewal or depreciation fund on the building of new locomotives, and all that is necessary is for that money to be laid out on the purchase of electrical motors and other equipment and on the adaptation of certain of its coaches to receive them; in other words, steam locomotives that have come to the end of their official "life" and whose value has over a series of years been written out of revenue and stands in the renewal fund can be renewed as electric motor coaches without any call upon capital.

My object in setting out these considerations is to emphasise the fact that the electrification of our outer suburban lines of railway is not such a formidable business from a capital expenditure point of view as is sometimes represented, and I hope also to be able to show that the advantages to be gained are real and commercial.

The question of the relative cost of working under steam and electrical conditions is one that must be approached with respect, as it is beset with difficulties and pitfalls. It is, of course, possible for an accountant to extract from a railway company's books figures representing all the elements that go to make up the cost of running a train for a given distance under both systems of working, but the figures, when obtained, while distinctly interesting and up to a point necessary, do not prove anything conclusively having regard to the many and various considerations that have to be taken into account. It is not possible to assess the value of these considerations in terms of money, but they are of such importance as frequently to be the determining factor in coming to a decision as to whether the substitution of electrical for steam working on a certain section of line is, or is not, a commercial proposition. It is usual on electrically-worked lines to use the car-mile as the basis of calculation, but, unfortunately, figures upon this basis are not available in the case of steam-hauled trains. I therefore make the comparison between a seven-car multiple-unit electric train and a seven-coach steam train of approximately the same weight and seating capacity. In both cases the costs connected with the running rails, stations, and signalling are excluded, being common to both methods of working. Under electrical conditions the working expenses may be divided under two heads, *viz.*:

1. The cost of energy as delivered on the conductor rail.
2. The cost of providing, maintaining, and manning the train.

Under the first of these heads must be included:—

(*a*) The cost of high-pressure energy as delivered at the sub-stations which, whether produced in the railway company's own generating station or purchased from a supply company, may be taken at to-day's normal prices at 0.7d. per unit.

(*b*) Interest on the cost of the sub-station buildings and machinery, together with their maintenance and depreciation, and the wages of the attendant staff. (This last-named item will be subject to reduction as the remote control of sub-stations becomes perfected.)

(*c*) Interest on the cost of the conductor rails, low-tension cables, ducts, &c., together with the cost of their maintenance and depreciation.

The total of these several items spread over the number of units employed gives the cost per unit of the energy as delivered on the rail. This total figure may be safely taken at 1d. per unit on the basis of to-day's normal prices. The amount of energy used per train varies, of course, with its weight, the gradients to be overcome, the rate of acceleration and other considerations, but an average consumption by a seven-car train of about 230 tons weight (including passengers) is, according to recent tests, approximately 17 units per mile, costing at the rate just named 17d.

Under the second head we must include—

(*a*) Interest on the cost of the train, its electrical equipment, wiring, &c., together with their maintenance and depreciation.

(*b*) The wages of the motorman and the guard.

The cost of these items spread over the number of miles run by the whole of the stock is found, at to-day's rates, to work out to about 35d. per seven-car train. Adding these figures together, we get a total cost per seven-car electric train mile of 52d. It is somewhat difficult to arrive at a figure representing the cost of working a steam train that would afford an exact comparison on all points with this figure. The result of recent tests, however, checked by official figures which are on an average basis, goes to show that the cost of steam operation per mile at present-day prices approximates to the same figure, *viz.*, something more than 4s. While this is an interesting fact, it is not one of first importance in its bearing on the matter under consideration, because, as previously pointed out, even if the actual cost of working per mile were greater under electrical conditions, such a disadvantage would be entirely outweighed by the other factors in the situation to which reference has already been made.

The agitation for better means of transport to and from the outer suburbs both of London and of the great provincial cities will certainly grow stronger and more insistent as the road congestion increases. In London, it has already led to a series of inquiries being held by the Ministry of Transport, and the results so far have shown that there is a pressing need for the provision of improved facilities in various directions. This does not necessarily mean new underground or "tube" lines, nor yet the provision of arterial roads to provide for greater motor travel. In many instances, the problem would be solved for some years to come by the conversion to electrical working of existing steam railways. I hope I have shown in the foregoing figures that the cost of such conversion would be comparatively light and the result would be that lines now being worked to a part only of their real capacity would be enabled to provide the required additional carrying accommodation to the advantage both of the owning companies and of the public to be served. Moreover, in making the conversion, railway companies would not be taking a step in the dark or doing anything that there might be a possibility of their having to undo. Everything points to electricity as the motive power of the future both from the point of view of ultimate economy and the conservation of our coal supplies, and every increase in its use brings nearer the time when our knowledge of its essence will be more complete and its utility to mankind more assured.

The Electrical Power Engineers' Association.

Annual Dinner of the Southern Division.

On Saturday last, the annual dinner given to the members of the National Executive Council by the Southern Division of the Electrical Power Engineers' Association, was held at the Hotel Cecil; Mr. A. H. Bennett, A.M.I.E.E., chairman of the Division, presided, and there was an attendance of not far short of 400 members and guests.

Mr. Frank Bailey, Mr. G. W. Partridge, and Major H. Richardson, who had intended to be present, sent messages regretting their unavoidable absence. Amongst the guests were Mr. S. L. Pearce, C.B.E., Capt. J. M. Donaldson, M.C., Mr. Hoadley, Mr. J. H. Parker, Mr. R. Phillips (president, I.M.E.A.), Mr. F. W. Purse, Mr. W. B. Thorpe, Mr. Percy Still, Mr. W. C. P. Tapper, and other well-known engineers.

After the loyal toast, Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P., Parliamentary Secretary to the Ministry of Transport, proposed "The Association," a trade union which, he said, had been weighed in the balance and not found wanting; the country and the Government owed it a debt of gratitude for the way in which it carried on during the general strike; under extreme difficulties it remained loyal to duty. His own functions were largely technical, and in connection with the Electricity (Supply) Bill he had received invaluable assistance from Mr. S. L. Pearce, whose departure from the Electricity Commission was deeply regretted. The members of the Association were proud of their generating stations, and consequently were liable to acquire a parochial outlook; in this highly industrial country their outlook should be from the standpoint of what was the best for all. A physical entity was being called into existence which must be good for the industry, the Association, and the whole country—the interconnecting "grid." Many small stations must be closed, but electrical development would go ahead rapidly; there was a splendid future for electricity, and no one would benefit more than the members of the Association. Water power of over a quarter of a million horse-power was going to waste; hitherto it had been very difficult to deal with it, but the establishment of the grid would give it an outlet. In the Severn tidal power of over 300,000 h.p. could be harnessed, and an important question was how to utilise low heads of 3 or 4 feet. It was a pity that the supply of gas and the supply of coal should be looked upon as inimical; coal was their common parent, and there was plenty of room for both. In Chicago, Mr. Samuel Insull had taken both in hand, and had developed an enormous gas supply industry. The consumption of coal in its raw state was coming to an early end; the pre-treatment of coal was being developed, and 15 gallons of oil could be extracted from every ton. If two gallons of motor spirit could be obtained per ton of coal, one quarter of our consumption would be covered. The future prosperity of the country depended on coal treatment; coal must be used for the benefit of the country as a whole. The railways were looking to electricity as motive power; they had a 30 per cent. load factor and a good diversity factor. With coal properly used this country should be the most highly developed electrically in

the world; in that development the members of the Association would play a great part, and he knew they would not disappoint him.

Responding, the President, Mr. A. J. Ostler, A.M.I.E.E., said that the presence of Lt.-Col. Moore-Brabazon was a reminder to all the members of the necessity for hearty co-operation between all parties concerned with the supply industry, to ensure the best results from the Government's Electricity (Supply) Bill. Judging by official reports, this progressive industry of theirs had developed cankerous growths, and the Government doctor had been called in to perform an operation of a very serious nature. As the President of an Association whose members, being in the position of the under-dog, would be seriously affected, he asked Col. Moore-Brabazon to make the treatment expeditious, so that the period of convalescence might quickly be reached. The Association desired to pull its weight in any reorganisation schemes which would result from the passing of the Act. In any reorganisation, some of their members—particularly those in the smaller generating stations—might suffer, temporarily, hardships which could be mitigated under the provisions of the scheme, but they believed that, taking the long view, the industry was so progressive, and would so expand, that there would be room for all. When he thought of the inconveniences and individual losses which might be incurred, he felt most sincere gratitude for the existence of their National Joint Board, on which they worked so excellently together under the genial chairmanship of Alderman Walker—whose unavoidable absence they all deplored. The reason for the success of the Board lay in the fact that neither body of representatives on that Board had permitted it to develop into a mere salaries or wages Board, but had endeavoured to use it as a means to benefit the industry in which it operated by creating that goodwill between staff and employers which was the very essence of the new spirit in industry that they were all striving after. They asked for recognition because the E.P.E.A. was the articulate voice of the technical staffs in the industry, who were greatly responsible for its efficient operation; much greater use could be made of their organised knowledge if some form of representation was given the Association on any advisory or executive bodies which might be set up. Co-operation was an obvious necessity if the best results were to be obtained. There were still a few who could not see why staff members should be organised as they were, into a protective organisation. It would be ancient history to recall the absurd salaries paid before the formation of the Association, which were one of the primary causes of its existence, but right from its inception, the objects that the Association laid down and which had never been altered, had all been altruistic and not individualistic, as some might suppose. The industry had always been looked upon as being greater than themselves. Their organisation had been a great influence for peace and smooth working, and no President had replied to the toast when the reputation of the Association stood higher than it did that day. They had gone through an unprecedented period of industrial unrest, and gained a reputation for right thinking and correct action. The members of a constitutional, non-political Trade Union, engaged in a key industry, just did their duty to their country. The future held for the Association much work to be done. Their high ideals were a long way from accomplishment. They had yet to ensure the success of the training of engineers' scheme, although much progress had been made; it must be admitted that the status of the supply engineer could not be raised to its proper level until such a scheme ensuring the entrance of the right men into the industry was assured. The idea of service to the industry was the very basis of their Association, and it was moving more and more towards a professional policy.

The Chairman, Mr. A. H. Bennett, proposed "Our Guests." Referring to the presence of Dr. W. H. Eccles, president of the Institution of Electrical Engineers, he remarked that the Association had always looked up to the Institution, which largely helped to bring it into existence. For some years they had been honoured by the presence of representatives of the Government at their annual dinner, and were glad of the opportunity of getting into direct contact with them. The chief engineers who were amongst the guests would realise from this year's work that the Association members were out to do their duty as Englishmen to the English public, and they could assist the Association materially with its scheme for the training of electrical power engineers to fill the posts that would be open as electricity supply developed. He hoped they would join the National Joint Board. The many contractors present he urged to co-operate in the great E.D.A.-E.L.M.A. campaign, the effects of which would be advantageously felt by the generating stations next year.

Dr. W. H. Eccles, F.R.S., responded, commenting on the vigour of so young a society, the strength of which proved that the organisation was a very necessary one. Those who watched its work knew how it had improved the status of station engineers, and he supported the president's plea that every station engineer should belong to the Association. The demand for power would grow so rapidly that more engineers would be required, and far from injury to them, there ought to be a wave of great prosperity. As a manufacturing nation we had to compete with other countries, and must electrify or die. In view of the increased cost of coal, many manufacturers would be unable to generate for themselves so cheaply as formerly, and would come on the public supply mains.

Mr. A. W. Crompton, senior past-president, in accordance with the traditions of the Association, made a presentation on behalf of the members to the immediate past-president, Mr. R. R. Telford, and Mrs. Telford, which the former appropriately acknowledged, remarking that during his year of office two notable events had occurred—the solution of the trouble with Halifax, and the initiation of the scheme of training power engineers.

An attractive programme of musical entertainment enlivened the proceedings.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Cooking by Thermal Storage.

I concur with your comments upon Mr. Settley's letter regarding the Swedish "Seves" cookers. Apparently, during the past two years, there has been a very great development in the design of the cooker arising out of the experience gained by having some 600 cookers in service. This particular cooker is widely used in the city of Stockholm. What is not generally appreciated is the very great rapidity of boiling on a hot plate, which is much faster than with gas or coal-fired stoves. As you state, roasting, baking, and grilling are done in a separate oven to which the current is temporarily diverted from the thermal-storage cooker. When supply mains permit, further heaters can also be added to the oven, so that the latter can be of any dimensions.

I hold no special brief for this particular cooker, but as I have done a considerable amount of experimental work in connection with thermal-storage cookers, it appeals to me that this particular development appears to have overcome many of the defects which have hitherto existed in this class of apparatus.

The general principle of these storage cookers certainly seems attractive to the central-station supply system, as the ordinary lighting mains can be employed without the necessity of having to increase their sectional areas. With a greater consumption of current, English methods of cooking can be employed. Undoubtedly the best plan is to slightly modify the methods, which would be all to the advantage of the cooking and greater economy to the user.

R. Borlase Matthews.

East Grinstead, *October 2nd*, 1926.

The Lightning Rod Act in Ontario, Canada.

With reference to Mr. Isherwood's letter in your current issue, criticising the regulations ratified by law in Ontario for lightning protection systems, I do not think he carries his point quite far enough.

Unless the surface soil is permanently moist, earth plates must be provided at both deep and shallow levels. This is for the reason that after spells of hot, dry weather the induced charge of which he speaks will not be found at the surface of the earth, but probably at some damp substratum. After rain, however, and this does not invariably occur during a thunderstorm, the induced charge will probably appear on the surface; hence the necessity for both deep and shallow earths.

A deep earth would appear to be necessary in the case of sandy deserts or chalk downs, where the conductivity of the earth is below average. The risk of lightning in these districts is, however, small, as the induced charge cannot be drawn to the surface so easily, but protection would probably be increased by carrying the earth down to a permanently damp level.

It would be very interesting if Mr. Isherwood would elaborate a little more fully his remark about the risk run by householders in connection with wireless aerials.

T. C. Gilbert,

Managing Director, T. C. Gilbert & Co., Ltd.

Folkestone, *October 2nd*, 1926.

Bermondsey Baths Contract.

We note the results now published (Electrical Review, September 24), for general information, that the Borough Engineer's Department has been awarded the contract by his own Council for the second portion of the Baths electric lighting scheme.

For us, the result was a foregone conclusion, having strongly in mind the manner in which electrical contractors were treated when the first portion of the electrical scheme was tendered for. The first result was that the price of the Borough Engineer's Department was by far the highest received, but when it was further decided by the Council to call for fresh tenders, the result was as just stated, namely, the Borough Engineer's tender was accepted—this, too, in face of additional work in the revised specification and without any information as to the results of tenders received.

We feel that we can congratulate ourselves upon abstaining from tendering in the second instance, having been "Once bitten!"

What comments have the Electrical Contractors' Association and other responsible contractors to offer?

Hadsom.

Current from the Mains.

I see by your foot-note under a letter of mine which you published last week that you ask to what regulations I refer. I am sorry that I neglected to mention that the regulations I had in mind are the I.E.E. ones, covering the wiring and equipment of buildings.

As these battery eliminators are to be supplied to the public and handled by them, I am of the opinion that they should be made to conform in every way to the above-mentioned regulations. I can enumerate a number of points, but perhaps it will suffice to mention the questions of (1) protecting the apparatus by fuses of the proper size, (2) making it impossible to get at terminals which may have the full supply voltage on them without first disconnecting the supply to the apparatus, (3) carefully bushing the cable entries to the apparatus, (4) effectively earthing all external metal work, (5) using condensers which can withstand at least four times the supply voltage.

I hope these few points will be sufficient to draw attention to the fact that apparatus connected direct to public electricity supply mains should be so constructed that there is no fear of shock when handled by the ordinary public.

A. W. Prangnell.

Acton, *October 4th*, 1926.

We notice in your issue dated October 1st a letter from Mr. A. W. Prangnell, of Acton, referring to apparatus exhibited at the recent Radio Exhibition for the purpose of operating wireless apparatus from the house mains. Mr. Prangnell states that most of the apparatus of this type exhibited would, to his mind, be unsafe.

Mr. Prangnell, however, states that there was one type at the Exhibition which did not merit this condemnation.

We have no knowledge as to the particular make to which Mr. Prangnell is referring, but we should like to call attention to the fact that in the three types of apparatus which we exhibited for this purpose, *viz.*, one for replacing h.t. batteries and running the set direct from the mains, one for charging h.t. batteries, and one for charging l.t. batteries, proper provision was made in every case by using enclosed terminals or enclosed connections for flexible leads to ensure complete safety in use, as far as concerns any possibility of shock from the mains, and that precautions were also taken to make it impossible to earth the mains.

Burndept Wireless, Ltd.

(P. K. Turner, *Research Department.*)

London, *October 4th*, 1926.

As makers and users of mains units for receiving sets, for over two years, we do not agree with Mr. Prangnell's attempt to make our flesh creep. There are many thousands of these sets in use, both professional and amateur made; their use involves no more risk than that of the breakfast-table electric toaster.

The use of a few milliamperes, through a high resistance or transformer, at a voltage generally under 100 is needlessly alarming Mr. Prangnell.

For **Electradix Radios.**

Millar L. Dixon.

London, *October 4th*, 1926.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 29th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Triotron (lettering and design). No. 463,068. Class 8.—Valves, instruments, and apparatus for use in radio-telephony; and Silver Star. No. 470,330. Class 8.—Apparatus for use in radio-telegraphy and telephony, but not including detector crystals and goods of a like kind. Julius Axelrad, 25, Mornington Crescent, N.W.1.

Emerald. No. 469,458. Class 8.—All radio-telephonic parts and apparatus, but not including wavemeters and goods of a like kind. Emerald Radio Co., Ltd., 10, Bush Lane, Cannon Street, E.C.4.

Unimic. No. 471,179. All goods in Class 8.—L. McMichael, Ltd.

Pival. No. 471,419. Class 8.—Apparatus for use in radio-telegraphy and telephony, and electrical instruments and apparatus. La Société Pival, Tulle (Correze), France. (J. O. O'Brien, Bank Buildings, King Street, Manchester.)

Resiston. No. 471,550.—All goods in Class 8, but not including electrical condensers or goods of a like kind. American Hard Rubber Co., New York, U.S.A. (Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Emerald (lettering and design). No. 471,947. Class 8.—Wavemeters for use in radio-telegraphy and telephony. E. Edgeworth, Southbrook Lodge, Avenue Road, Bexley Heath.

Venoff. No. 472,117. Class 8.—Electrical time switches. Venner Time Switches, Ltd.

Tocite. No. 472,166. Class 8.—Electric cables. Callender's Cable & Construction Co., Ltd.

Ducer. No. 470,774. All goods in Class 13.—Electro-Ducer, Ltd., 324, Upper Street, Islington, N.1.

Maxim (lettering and design). No. 470,881. Class 16.—Electric lamps. Poynter, Griffiths & Co., Ltd., 75, Canonbury Road, N.1

Published Specifications.

Compiled expressly for this journal by patent agents. The name of the applicant's patent agent, if any, will be found on the printed specification. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

6,367. "Static electromagnetic translators and amplifiers." A. H. Railing and A. E. Angold. November 25th, 1925. (257,964.)

9,323. "Electric switches, specially applicable to press-button and the like automatically-operated switches." F. B. Cox. April 8th, 1925. (257,966.)

9,356. "Telephone systems." Standard Telephones & Cables, Ltd., formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). April 8th, 1925. (257,967.)

10,282. "Swivelling headlights of automobiles." E. O. Rutter. April 20th, 1925. (257,969.)

12,302. "Cooling of dynamo-electric and other machines." Enclosed Motor Co., Ltd., N. W. Gilbert, H. C. E. Jacoby and A. E. Jabet. May 12th, 1925. (257,974.)

12,573. "Motor-car head-lamps." H. Workman. May 14th, 1925. (Cognate applications 20,341/25, and 4,245/26.) (257,976.)

14,575. "Sound recording and reproducing apparatus." P. A. Garlazzo. June 4th, 1925. (257,983.)

14,752. "Variable electric condensers." H. V. Flinn. June 6th, 1925. (257,988.)

14,958. "Telephonic receivers." E. A. Graham (deceased). June 9th, 1925. (257,996.)

15,008. "Thermionic valves." General Electric Co., Ltd., A. C. Bartlett, B. S. Gosling and R. Le Rossignol. June 9th, 1925. (257,999.)

15,094. "Telephone receivers and transmitters and the like electromagnetic instruments, and the manufacture thereof." British Thomson-Houston Co., Ltd., A. P. Young and J. Hutt. June 10th, 1925. (Addition to 236,680). (258,000.)

15,135. "Electric lighting by means of vacuum tubes." J. S. Blanckensee. June 10th, 1925. (258,004.)

15,259. "Route-indicators for railways and the like." E. W. Challans, L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. June 12th, 1925. (258,010.)

15,294. "Head-attachment gear for telephone receivers." British Thomson-Houston Co., Ltd., A. Eastlope and J. Hutt. June 12th, 1925. (Addition to 237,017.) (258,011.)

15,322. "Remote control systems." Automatic Telephone Manufacturing Co., Ltd. and C. Remington. June 12th, 1925. (258,012.)

15,379. "Automatic telephone systems." Standard Telephones & Cables, Ltd. (formally Western Electric Co., Ltd.), A. M. Searle and J. H. E. Baker. June 13th, 1925. (258,013.)

15,671. "Electromagnetic sound recording and reproducing machines." H. P. O'Reilly. June 17th, 1925. (258,021.)

15,827. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 17th, 1924. (241,322.)

15,851. "Electrical step-by-step mechanism." I. H. Parsons and A. E. J. Ball. June 19th, 1925. (258,022.)

15,858. "Variable electrical condensers." J. H. Banks, G. H. Banks, and R. V. Banks. June 19th, 1925. (258,023.)

16,104. "Telephone systems." E. C. R. Marks, (American Telechronometer Co.). June 22nd, 1925. (258,025.)

16,854. "Wireless apparatus." T. F. Stent and Edison Swan Electric Co., Ltd. June 30th, 1925. (258,030.)

17,136. "Sound-reproducing sets suitable for the reception of wireless telephony." British Thomson-Houston Co., Ltd., T. H. Kinman, and H. W. H. Warren. July 3rd, 1925. (258,034.)

17,325. "Flux materials for use in arc-welding, and methods of coating electrodes therewith." Hume Steel, Ltd., and W. R. Hume. July 6th, 1925. (258,036.)

17,733. "X-ray screens." Dr. R. Mannl. July 11th, 1924. (236,951.)

18,600. "Bobbins for receiving the windings of electrical apparatus." J. Bate and C. A. Vandervell & Co., Ltd. July 21st, 1925. (258,046.)

18,786. "Heat-treatment of materials by electricity." W. J. Brown and Metropolitan-Vickers Electrical Co., Ltd. July 23rd, 1925. (258,049.)

20,353. "Blow-out arrangements for electric fuses." English Electric Co., Ltd. August 13th, 1925. (258,059.)

20,811. "Engine starter." F. B. Dehn (Aeromarine Plane & Motor Co., Inc.). August 19th, 1925. (258,064.)

26,670. "Stacks of electrical appliances." Dubilier Condenser Co. (1925) Ltd. October 24th, 1924. (241,945.)

28,311. "Means for electrically operating stamping, embossing and the like machines." T. Henry. November 10th, 1925. (258,121.)

30,040. "Vacuum tube and radio testing devices." W. M. Scott and R. E. Tresise. May 22nd, 1925. (252,316.)

30,731. "Receiving systems for the detection of signals from high-frequency waves." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 5th, 1925. (258,131.)

31,132. "Astatic alternating-current meter according to the Ferraris principle. Landis & Gyr Soc. Anon. December 19th, 1924. (244,755.)

31,815. "Sound-reproducing devices applicable to telephones, phonographs, or the like." A. F. Sykes. March 9th, 1925. (Cognate application 31,931/25). (Divided application on 243,395). (258,137.)

1926.

766. "High-frequency electric signalling and remote control systems." British Thomson-Houston Co., Ltd. January 14th, 1925. (246,139.)

1,912. "Thermionic discharge tube devices." Westinghouse Electric and Manufacturing Co. January 27th, 1925. (246,832.)

2,543. "Automatic reclosing circuit-breaker systems and apparatus." Igranic Electric Co., Ltd. (Automatic Reclosing Circuit Breaker Co.). January 28th, 1926. (258,150.)

3,034. "Electric discharge vessels." Siemens-Schuckertwerke Ges. February 28th, 1925. (248,342.)

4,641. "Safety switches adapted for use with wireless telegraphy and telephony receiving apparatus." J. R. Gardener. May 10th, 1926. (258,160.)

5,986. "Control systems for electric welding-apparatus." British Thomson-Houston Co., Ltd. March 3rd, 1925. (248,735.)

6,844. "High-frequency electric furnaces." C. Lorenz Akt.-Ges. March 30th, 1925. (249,843.)

7,670. "Electric vacuum cleaners." Siemens-Schuckertwerke Ges. December 14th, 1925. (Addition to 244,795.) (258,169.)

8,648. "Table for Röntgen-ray examinations and photography." W. Otto. April 3rd, 1925. (250,236.)

8,913. "Control of apparatus at an electric power sub-station from a central control office." Automatic Telephone Manufacturing Co., Ltd., and C. Remington. June 12th, 1925. (Divided application on 258,012.) (258,178.)

8,914. "Remote control systems." Automatic Telephone Manufacturing Co., Ltd., and C. Remington. June 12th, 1925. (Divided application on 258,012.). (258,179.)

9,533. "Single-core cables." Felten & Guilleaume Carlswerk Akt.-Ges. June 13th, 1925. (253,485.)

9,956. "Vacuum-tube generators of high-frequency alternating electric currents." Westinghouse Electric & Manufacturing Co. April 28th, 1925. (251,609.)

10,221. "Electromagnetic operating means for electric motor controllers and switches." British Thomson-Houston Co., Ltd. April 18th, 1925. (250,976.)

10,391. "Means for supplying current to electric motors sunk in bore-holes." Siemens-Schuckertwerke Ges. May 11th, 1925. (251,960.)

10,548. "Electric motor control systems." General Electric Co., Ltd. (A. Laternser.) (April 21st, 1926. (258,192.)

11,075. "Electric couplings or terminals." Klaxon, Ltd., and J. F. Monnot. April 27th, 1926. (258,197.)

15,175. "Photo-electric systems." British Thomson-Houston Co., Ltd. June 19th, 1925. (253,916.)